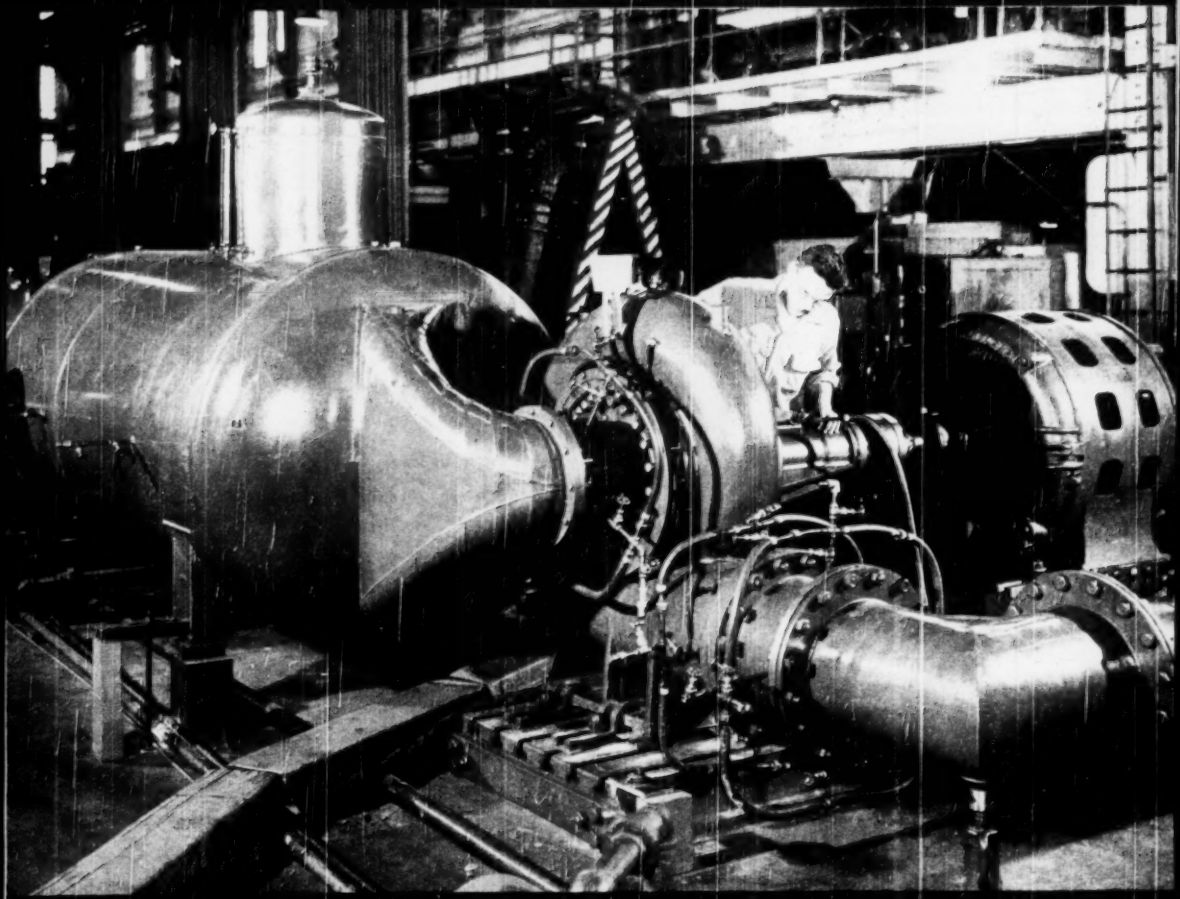
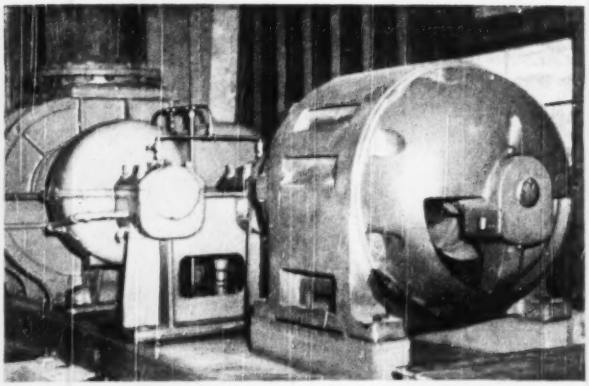
ENGINEERING NEWS-RECORD

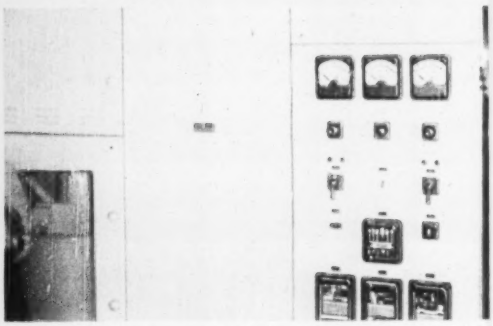


A McGRAW-HILL PUBLICATION

Ventilation for the Delaware Aqueduct tunnel is provided by blowers driven by sturdy G-E 200-hp induction motors. ▶



▲ Muck is efficiently hauled by 18 G-E battery and battery-trolley locomotives.



▲ Adequate d-c power for trolley service is obtained from eight G-E 150-KW stationary mine-type mercury-arc rectifiers specially designed for this project.

tunneling through the CATSKILLS

... *Electrically*

to bring more water to New York City

Adding 300 million gallons a day to New York City's water supply is a big job no matter how it's done. To lichly bring it from the Delaware River, the Walsh Construction Co. and W. Perini and Sons must bore 25 miles through the Catskill Mountains. At about 50 feet a day, they've still a long way to go, but expect to complete the job around July 1955 with *electrical* equipment coordinated and engineered by General Electric.

Every day, more contractors are looking to reliable *electrical* equipment for flexibility, safety, and ease of maintenance. With equipment driven by G-E motors and control, and supplied from G-E power distribution systems they get modern, *electric drives* with the added advantages of G-E engineering assistance in application, installation and service. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

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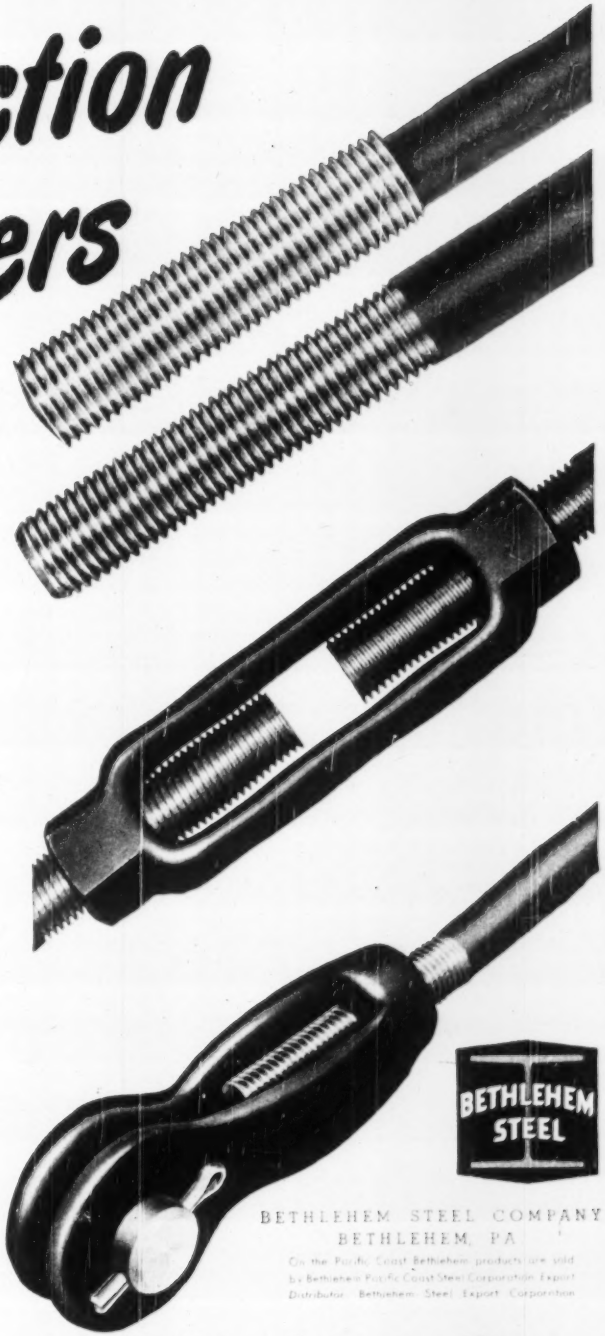
LOWER COST

GENERAL ELECTRIC

Construction Fasteners



TIE-RODS

Bethlehem Tie-Rods come in two types: (1) rolled-thread rods in thread diameters up to 1½ in., and (2) cut-thread rods, plain or upset, in thread diameters up to 4½ in. Furnished in any length, straight or bent, in single or multiple units, either asphaltum-dipped or hot-dip galvanized.

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Bethlehem Turnbuckles in thread sizes ⅜ in. to 2⅝ in. with 6 in. openings between the heads, are available from stock. Right- or left-hand threads, with or without stub ends. Larger sizes also available.

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ENGINEERING NEWS-RECORD

AIEP Member ABC

Volume 145 JULY 13, 1950 No. 2

Walter G. Bowman
Editor

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FOR THE 14th TIME

Farnsworth and Chambers, Inc., Houston, Texas works *"IN THE DRY"* with MORETRENCH!

Official Photo — New Orleans District, Corps of Engineers

Again and again this well known contracting firm selects Moretrench Wellpoint Equipment.

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Progress and profit on a wet job frequently depend on *how* you pump it. That's why experienced contractors depend on Moretrench Equipment and Moretrench know-how for quick, economical predraining on every type of wet project.

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SEE OUR CATALOG IN SWEETS FILE

THE MACOMBER V BAR JOIST WAS APPROVED BY THE STEEL JOIST INSTITUTE ON OCT. 23, 1946

POSITIVE ANCHORING OF TOP LATH PREVENTS DEEP POCKETS OF CONCRETE BETWEEN JOISTS.

NAILING TOP LATH IS FASTER THAN CLIPPING OR WIRING. YOU SAVE LABOR AND MATERIALS ON EVERY SQUARE YARD OF FLOOR YOU BUILD WITH MACOMBER V BAR JOISTS.

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MACOMBER NAILABLE V BAR JOISTS

When you see that staple or roofing nail in the illustration above driven over the rib, you know why top lath is securely anchored to Macomber Steel Bar Joists.

But when you witness this fast operation on one of YOUR OWN jobs, you will know why the industry calls them "Builder's Units"—saving hours of lath application time and saving dollars in preventing deep pockets of wasted concrete between joists.

There is no other Steel Joist like it in the world! If you had to pay a third more for this nailable joist, you would still prefer it but Macomber V Bar Joists are competitively priced with any Approved Steel Joist.

Write for catalog. See that these advantages are known all along the line to keep within today's close bids.

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• Wherever there's earth or rock to be moved...wherever there's need for *extra* performance, *extra* stamina, *extra* dependability—there you'll find a job that's made to order for a Mack.

Mack's proved superiority in earth moving work rests on *built-in superiority* of design and construction. In addition to their inherent power, strength and durability, Mack trucks bring you outstanding advances in maneuverability, ease of control, positive traction and maintenance accessibility.

Follow the lead of profit-wise operators who have discovered from actual experience that when it comes to working harder, lasting longer and operating at lowest cost—there's nothing to equal a Mack. Your nearest Mack branch or distributor will give you the full story on what Mack's *sustained earning power* can mean to you in greater profits through greater output at lower cost.

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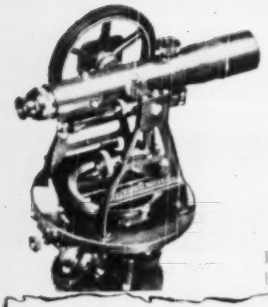


WHAT A LEADING TECHNICAL EDITOR WROTE ABOUT ALUMINUM TRANSITS AFTER ANALYZING HOW GURLEY MAKES THEM

Reproduced from a full-length article in the December 1949 issue of MATERIALS & METHODS, written by H. R. Clauser, its Associate Editor. We will gladly send you reprints of the entire article on request.

Aluminum Used Successfully in Precision Instruments

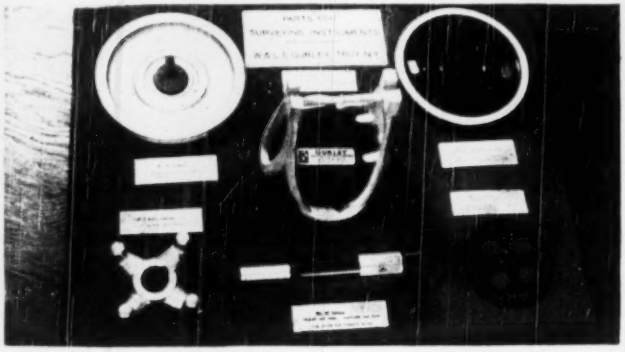
A PICTORIAL STORY

Requirements of accuracy during a long service life are controlling factors in selection of materials for engineering and surveying instruments.

• IN THE MANUFACTURE of precision instruments, the selection and careful processing of materials is of prime importance. Accuracy as well as long service life with a minimum of adjustment and repair are the quality standards that must be met, and to meet them, astute materials engineering coupled with expert workmanship are required. Perhaps no better example of the combination of these two factors can be found than at W. & L. E. Gurley, Troy, N. Y., where precision instruments are produced not only for engineering and surveying, but also for other fields such as meteorology and aeronautics.

Copper alloys and aluminum alloys are the principal materials used in the company's surveying instruments. One of the earliest uses of aluminum in this country was in a Gurley transit 73 years ago. And since that early application, aluminum has proved satisfactory in an increasing number of instrument parts. The main reasons for adopting the use of aluminum were: (1) light weight, (2) relatively high strength and yield point, (3) lends itself to precision machining; (4) good ductility; (5) relatively good corrosion resistance, especially in sulfur atmospheres; and (6) does not distort nor "grow" with age. The aluminum alloys most used at present are 14SW, 61ST, 356 and 13. A thorough test program insures against any differences in accuracy within a temperature range of —80 F and +165 F.

The accompanying pictures illustrate a number of the steps involved in the production of various parts making up the transit.



1—Shown here are the aluminum parts used in Gurley surveying instruments. At top, left and right is a 14SW forging for a horizontal transit limb before and after being machined, anodized and dyed. In the center is a sand casting of 356 alloy for the truss standard. Lower row, left to right, is a transit leveling head sand casting of 13 alloy, a swaged and spun tubing for telescope focusing slide of 51ST alloy, and a graduated vertical circle made of 61ST aluminum sheet which has been anodized and dyed.

You're So Right, Mr. Editor—

The first Gurley Aluminum Transit, built in 1876, was finally retired after 50 years of active service—and then for sentimental reasons only. It met every field "requirement of accuracy during a long service life"—as every Gurley Transit continues to do all over the world.

W. & L. E. GURLEY, UNION PLAZA, TROY, NEW YORK

Surveying and Engineering Instruments, Hydraulic Engineering Instruments, Standard Precision Weights and Measures, Paper and Textile Testing Instruments, Reticle-Making Facilities, Aeronautical Navigating Instruments, Meteorological Instruments

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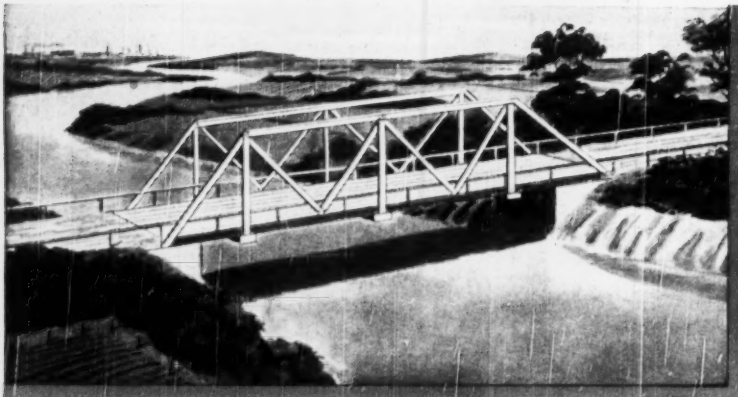

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Wood bridges and wood planking on steel bridges are constantly exposed to decay, and in many parts of the country, to insect attack as well. For protection against these two enemies of long and useful life, many bridge designers are specifying PENTAchlorophenol, *the modern wood preservative.*

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For more complete technical information and assistance write to Dow, Dept. PE-38A.

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How Wood Experts Regard PENTA

Leading utilities are specifying a PENTA treatment for poles in ever increasing numbers. Their own extensive research has proved to them that PENTA is a *better* wood preservative. Profit from their experience. The next time you need a wood preservative, specify PENTAchlorophenol.

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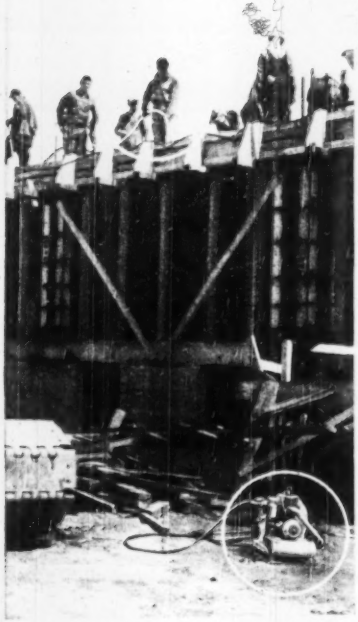

Homelite Generator on ground powers vibrators on top of forms.

One man with a CP-Homelite unit, placing concrete as fast as it is delivered, does the work of an ordinary three man crew. Place the Homelite Generator in any convenient location—out of the way of the actual pouring operation—and use the CP-Homelite Electric Vibrator anywhere in a radius of 400 feet.

There's no flexible shaft to give trouble. You can bend the tough electric cable—in its neoprene hose handle—around corners or over forms without injuring it. And the extension hose handle permits working 25 feet down in a form. CP-Homelite Hicycle Vibrators run at a constant speed of 10,000 v.p.m., the most suitable frequency for concrete placement and will handle 30 to 40 cubic yards an hour of 2" slump concrete.

Your Homelite Generator will operate two vibrators and will also power other Hicycle tools, standard Universal Electric tools, and floodlights. Write for full information.

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Pumps • Generators •
Blowers • Chain Saws
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No other Paver offers so much!

A greater range of sizes to choose from for your particular problem. Three sizes, from the 27-E (ideal for general construction work with the HighLift Boom) to the 34-E DuoMix for the heavy road job.

- Greater simplicity of design — only one main shaft, everything in units and easily get-at-able — you don't have to be a mountain goat to take care of a MultiFoote.
- All high-speed shafts on anti-friction bearings sealed against dirt.
- More engine power.
- A simple, direct, fast skip hoist — less cable wear, easy to reave.
- Skip "A" Frame easily lowered by power, reduces skip hoist power required, reduces cable tension and lengthens skip hoist cable life.
- Double Cone Drum does not build up in the corners, reduces time required for cleaning.
- Helical Gear Drive built as a separate unit. The finest speed reducer on any paver.
- Crawlers with real self-cleaning action, no pockets to fill, no U bolts or overhanging axles to give trouble.
- Mechanical control for either manual or automatic cycle is free from delicate mechanisms. Your paver can't be shut down because of control failure.
- The HighLift Boom — an asset that puts concrete 23 feet up (higher with special booms) allows you to pour wall without ramps, false work or hoisting equipment.
- Other advantages that mean low cost operation and higher output.

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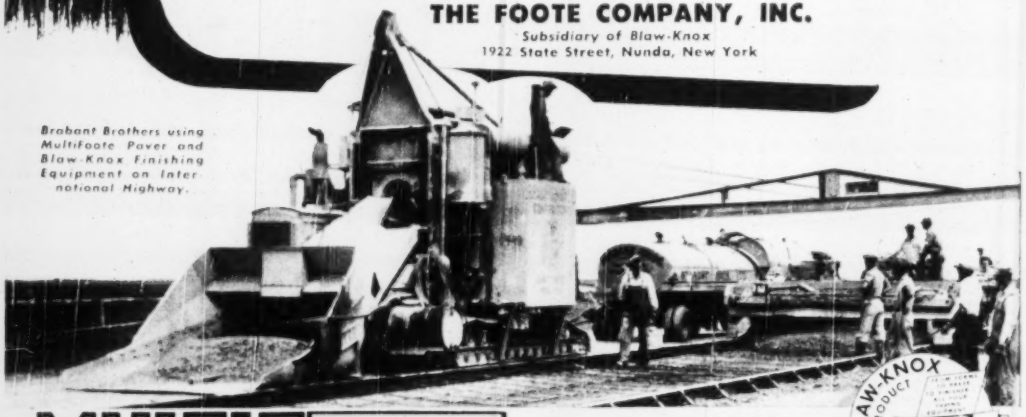
Subsidiary of Blaw-Knox
1922 State Street, Nunda, New York



Brabant Brothers using MultiFoote Paver and Blaw-Knox Finishing Equipment on International Highway.

MULTIFOOTE PAVER

FOR EVERY PLACE CONCRETE MUST BE POURED

Do you lay Black Top? The Adnun is an all 'round Black Top and Material Spreader. One machine for black top, stone, slag, cinder, sand or soil cement. Does the job with less cost for subgrade preparation—Ask for details.

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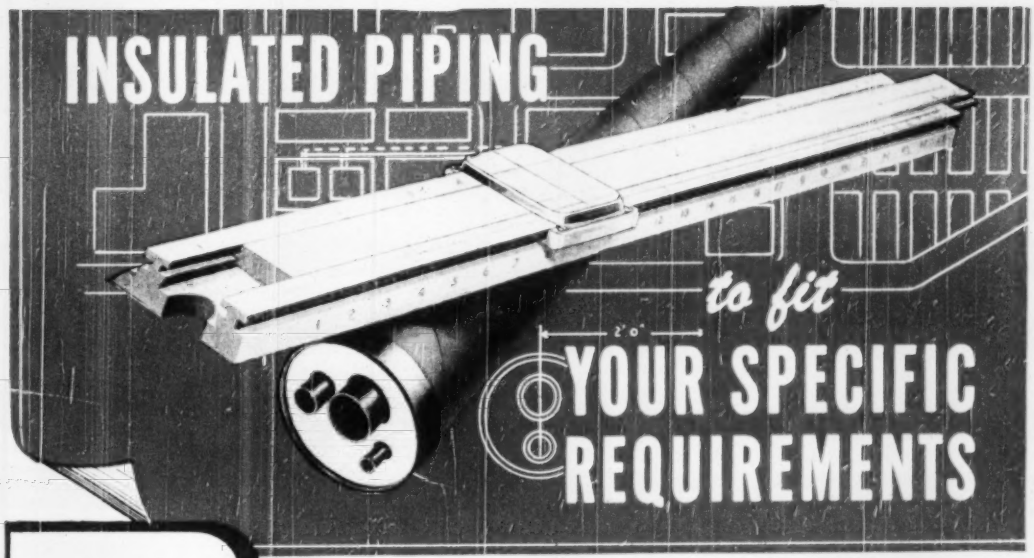
INSULATED PIPING *to fit* YOUR SPECIFIC REQUIREMENTS



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TEE BRANCH

PLATE ANCHOR UNIT

From the first rough plans through every phase of designing, engineering, and installation, Ric-wiL Pipe Engineering Service is available for assistance to engineers and contractors. No matter how special or intricate the problem may be, Ric-wiL engineers can help solve it with a prefabricated system *that will fit accurately when it gets to the job.*

Every Ric-wiL product is engineered—not to fit a general requirement—but specifically designed and prefabricated to provide low cost installation and high operating efficiency for your specific insulated piping system. Built by skilled mechanics in modern plants under ideal working conditions, Ric-wiL products are made under strict control in all details, labor and materials.

Ric-wiL piping engineering assistance, plus Ric-wiL installation economies, plus long maintenance-free, high efficiency operation make Ric-wiL your practical answer to all insulated piping problems.

At your request, the Ric-wiL representative nearest you will be glad to provide Ric-wiL technical information as applied to your specific problem.

Prefabricated Ric-wiL Accessories insure installation economies and top operating performance. Built of the same top quality materials as all Ric-wiL products, they are prefabricated to exact engineering specifications.

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 10-KA in Cleveland, Ohio.

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BRIGGS & STRATTON
GASOLINE ENGINES

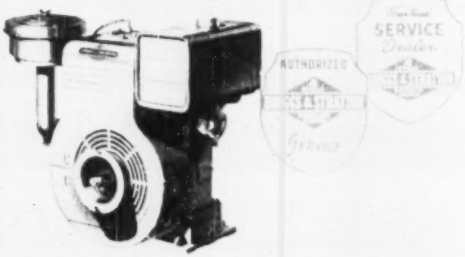
World-wide
SERVICE

Through the Largest Network of its Kind in the World

There is a Briggs & Stratton service organization, factory-trained and supervised, near you — with a complete stock of genuine Briggs & Stratton parts for all models.

Briggs & Stratton service is world-wide — and constitutes the largest network of its kind. It is an important part of Briggs & Stratton's continuous effort to make its engines of greatest constant value to their users.

BRIGGS & STRATTON CORP., Milwaukee 1, Wisconsin, U.S.A.



In the automotive field Briggs & Stratton is the recognized leader and world's largest producer of locks, keys and related equipment.

NEWS BRIEFS

Against the Trend—Los Angeles School District has postponed temporarily a contract letting for a junior high school physical education building. Low bid ran $75,000 above the estimate. The school board's business manager said bids have been running considerably higher than estimates for school jobs. So the board chose postponement until it can find what's wrong. Higher wages for carpenters and increased lumber costs are possibilities.

They're Not Alone—New Jersey Turnpike Authority officials can't decide between bituminous concrete and portland cement concrete for the paving of their 118-mi highway. They'll ask bids on both types before deciding.

Wanted: Roads, Not Plans—Federal, state and county highway officials in St. Louis county, Mo., will undertake a new survey of the county's future highway needs. County officials anticipate "a real highway program out of this survey, not just a pencil program."

How Nice!—Lowell, Mass., engineers have discovered a big new water source near an existing field. The new source would yield 5,000,000 to 6,000,000 gal daily. Its water may be pumped directly into the mains without purification. Three gravel-packed wells and three pumphouses will cost about $104,000.

Hands Across the Falls—Canada's Parliament has approved without debate the Niagara water diversion treaty negotiated some time ago. It provides for beautification of the Falls, limits the amount of water which may be withdrawn above them and divides equally between the U. S. and Canada the extra diversions it permits.

The Industrial South—Westinghouse Electric Corp. will build a manufacturing and repair plant at Birmingham, Ala., to provide overhaul and repair facilities for its customers in that state. Two brick and steel one-story structures will be built on a 400×500-ft tract, to be done in a cycle.

Let's Get At It—Leif J. Sverdrup, chairman of the Bi-State Development Agency, said bills will be presented to the Missouri and Illinois legislatures next year seeking broader powers for the agency in connection with sewerage and drainage facilities.

Continued on page 14

REPORT CARD

HORACE MANN SCHOOL

REPORT ON:

J&L JUNIOR BEAMS

J&L STEEL

Left—Workman easily guides notched Junior Beam into place during construction of Horace Mann School.

Below—Completed school showing clean functional design and unique cantilever construction.

Remarks: **J&L STEEL JUNIOR BEAMS solve unique design problem *AT LOW COST***

At the Horace Mann School in Warren, Ohio, J&L Junior Beams have again demonstrated that they can do a better job in unusual applications, as well as in ordinary styles of buildings.

Notched over lintel beams and cantilevered three feet beyond the outside walls, J&L Junior Beams support not only the roof but also an attractive permanent sun shield over classroom window walls.

Because of their versatility and adaptability, J&L Junior Beams go far towards meeting the demands of today's builders. They cost less to buy and less to erect. At Horace Mann, Warren Engineering Company, who erected the school, assisted by J. A. McMahon, Ltd., Niles, Ohio, steel fabricators, has found that lightweight, 12" Junior Beams, *30 ft. long*, may be easily raised, placed and bolted directly into place by three men with the aid of only a hand-operated winch.

This means *dollars saved*—through speed of erection, elimination of secondary operations, and ease of handling. Yet in light structures, J&L Junior Beams often offer all the advantages of heavier structural members.

Junior Beams, made *exclusively* by J&L, are the lightest weight hot-rolled steel beams available.

In schools, office buildings, apartments, residences, industrial buildings, hospitals, and other light occupancy structures, J&L Steel Junior Beams offer the *modern* builder many advantages. They are economical . . . fire-safe . . . rigid . . . shrink-proof . . . termite proof . . . easy to install . . . low in maintenance . . . and are permanent.

ARCHITECTS • BUILDERS • CONTRACTORS

It will be worth your while to follow the lead of Arthur E. Sidells, architect for the Horace Mann School, Warren S. Holmes, consulting architect, and William C. Fisher, structural engineer on the job. Send for descriptive literature and engineering data on J&L Steel Junior Beams and J&L Junior Beam floors.

USE THE COUPON

Jones & Laughlin Steel Corporation
428 Jones & Laughlin Building
Pittsburgh 30, Pa.

Please send me a free copy of your new booklet on J&L Junior Beams.

NAME _____

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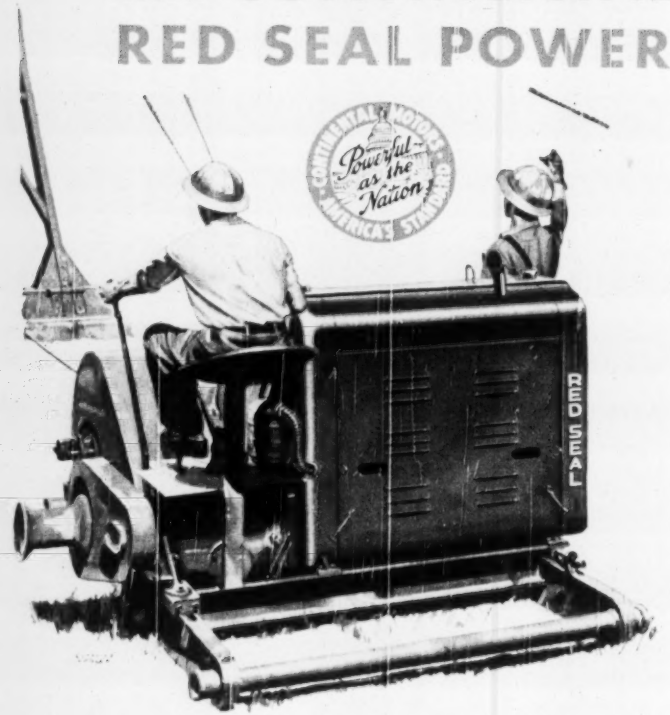
From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in stainless and special (extensile steels).

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIPE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

GOOD EQUIPMENT IS BETTER

WITH CONTINENTAL

RED SEAL POWER



In the construction industry, as elsewhere, there's growing recognition that good equipment is better with Continental Red Seal power. One of many reasons WHY it's better is Continental Motors' policy of engineering the power plant expressly for its work. There are Red Seal industrial models from ¾ to 140 horsepower, built to hundreds of different specifications, in a variety of shapes and profiles, with performance characteristics suited to a wide range of jobs. It will pay you, when buying industrial or construction equipment, to choose a make with Red Seal power.

IN PARTNERSHIP WITH AMERICA'S LEADING
BUILDERS OF POWERED EQUIPMENT

Continental Motors Corporation

MUSKEGON, MICHIGAN

(Continued from page 12)

Sverdrup said the agency is charged by the two states with planning and constructing airports, bridges, tunnels and terminals, but that it has jurisdiction only to plan and establish policies for sewerage.

Helps Night Drivers—New York is following the lead of other states in using glass beads in painted highway markings that divide traffic. The beads glow under headlight illumination and help traffic on curves and in foggy stretches. Cost is about $14 per mile more than for conventional painted markings.

Inflation Note—Two toll increases are facing Connecticut highway users. Commercial vehicles on the Raymond E. Baldwin Bridge, across the Connecticut River between Old Saybrook and Old Lyme now must pay 10 cents per axle, double the earlier figure. And the Highway Department plans a new toll booth in Willingford on the Wilbur Cross Parkway, where an extra dime will be collected, or about $325,000 yearly. The latter boost is blamed on a desperate shortage of highway funds. The former arises from a traffic decline on the bridge, believed to be induced by competition from the Wilbur Cross Parkway.

Complications Ahead—Not life in the Federal Power Commission isn't sufficiently involved—what with the competition between the Pacific Gas & Electric Co. and the Reclamation Bureau for licenses to develop hydroelectric sites—now there's an added starter. G. E. Currico, a San Francisco contractor, has asked FPC for a preliminary permit to build four dams and three powerhouses on the Eel River and its tributaries in Trinity and Mendocino counties, Cal. He would sell the output to PG&E.

More Steel Expansion—Great Lakes Steel Corp. will build a new blast furnace at its Ecorse, Mich., plant, adding 440,000 tons of pig iron capacity per month. It will also rebuild and enlarge an open hearth there to give it a capacity of 500 tons per heat. With some open hearth rebuilding at Weirton, W. Va., the program, by the parent National Steel Corp., will total about $25,000,000 in cost.

Field Work—Illinois' Sanitary Water Board will establish a field laboratory to help in its search for causes of pollution in several streams in southern Cook County (Chicago). The problem there is described as one of the worst in the state. It's believed to be caused by industrial wastes and domestic sewage.

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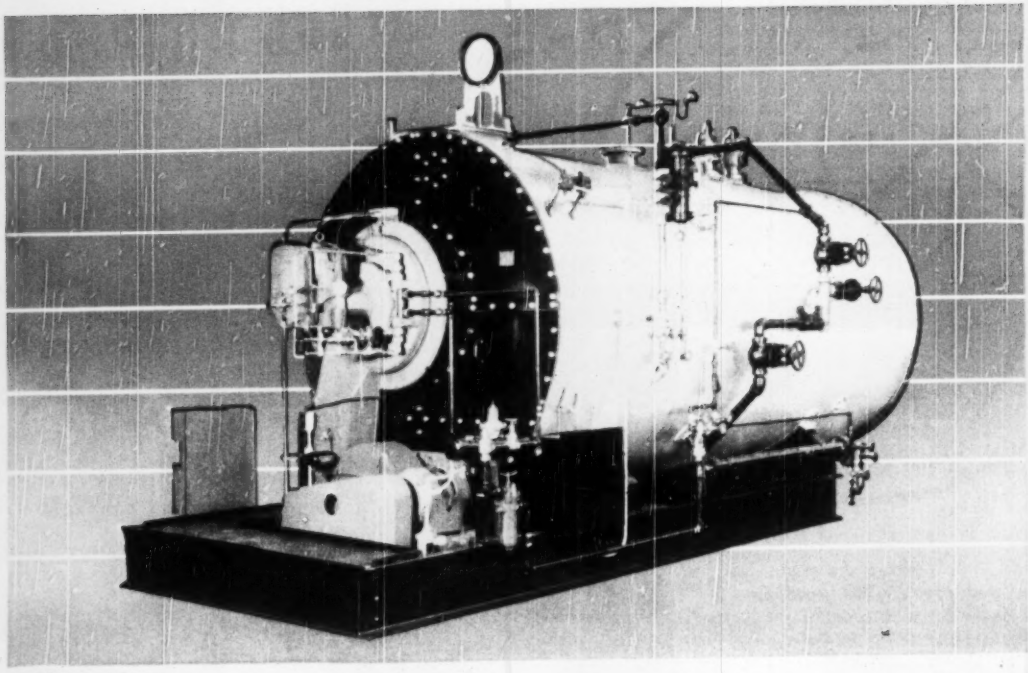

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THE CONSTRUCTION WEEK

HOW WASHINGTON'S PLANNING—Assuming the Russians don't engage in a new and overt act of aggression, Washington's attitude seems to preclude any hasty mobilization—or imposition of economic controls. The attitude is one of studied optimism, and it's not faked. The top level still believes that War III isn't at hand. But it does recognize that the situation is grave. Until there can be some firm determination of how well the risk was calculated, the effort will be to avoid any emergency at home. Stand-by plans are being made, of course—have been under preparation at least technically since the National Security Resources Board was organized soon after the war. But no discussion of them is wanted which would induce "scare buying." And there are no present plans to send mobilization legislation to Congress, broad as the planning is. A rise in military buying seems sure—it doesn't require any action by Congress. The normal defense orders, which would be placed when a new appropriation bill becomes law, will be going out soon. Expectation is that the funds will be committed rapidly—Congress can always ok deficiency funds early next year if they're needed. Such a schedule would tend to avoid undue impact on business.

BULLDOZERS STILL FIRST—Despite the official calm in Washington, construction men can easily remember that the last war was in large part a construction war and be uneasy about this one. For one thing U. S. troops again are involved in places where there are no roads, poor railroads, few harbors, no housing, sorry airfields. Also, a general mobilization would be a serious blow to construction, manpowerwise. But more serious, for the consideration of the planners is this: With construction machinery manufacturers just about able to meet their commitments now, demands for more military equipment of this type can be a serious strain, even without an all-out call.

MORE PLANT NEEDED?—One possible effect on construction of the Korean intervention may come in stepped-up plant building. Whether industrial capacity is rising rapidly enough is a subject that has been high in administration thinking since early postwar days, you'll recall. The Spence bill, federal power expansion, continued federal control of synthetic rubber facilities, proposals for a synthetic oil industry are some of the symptoms. There's still strong administration feeling that certain basic industries' expansion plans are insufficient. Steel, power and non-ferrous metals are mentioned most commonly. Korea brings this issue back into focus again. If war comes, the need would be apparent. It it doesn't, you can still expect new federal pressure for stepped-up expansion—by federal if not private capital. And that's the Spence bill's concept.

WHAT PRICE POWER?—Dinosaurs have lost a round to federal power. Interior Secretary Chapman has ok'd USBR plans for two multi-purpose dams within the Dinosaur National Monument, in Colorado and Utah. The bureau may now seek Congressional authorization and funds for Echo Park and Split Mountain developments. These would have a total capacity of 320,000 kw, cost $207,100,000. Plans were opposed bitterly by conservationists and Interior's own National Park Service. These were over-ridden in part by engineering testimony that any upper Colorado River development, in the absence of Echo Park and Split Mountain, would lose 350,000 acre-ft of water annually through evaporation. Chapman, after a hearing, said he wanted to create no precedent for tampering with the inviolability of national parks and monuments, but held the need for water to be overpowering.

SAUCE FOR ST. LOUIS—East St. Louis, Ill., went into the toll bridge business across the Mississippi after seeing how a neighboring community struck it rich by purchasing a private toll bridge. (ENR Feb. 9, p 17). As a result, St. Louis, Mo., sees a chance to add $38,650 to the city's revenue this year—and more in future years. For a long time, St. Louis has been unhappy about paying taxes to St. Clair County on the city's free bridge—that portion of it extending into Illinois. So St. Louis will tax that portion of the new bridge—due to be opened about Oct. 1—which extends into Missouri. For this year, the valuation has been set at $1,410,610 for tax purposes. That figure will rise to between $1,500,000 to $2,000,000 when the structure is opened to traffic.

COMPETITION, NO DOUBT—Builders of the 1,600-unit Windsor Park apartments in New York City are spending $100,000 to provide an intricate master television antenna system for their prospective tenants. There'll be two masts on each of the 18 buildings, and coaxial cables will lead to a recessed wall outlet in each apartment. There'll even be a maintenance man on duty eight hours daily to keep the service trouble free. Readiness of builders to spend that kind of money on an "extra" for tenants indicates, perhaps, an approaching saturation of such projects in New York City.

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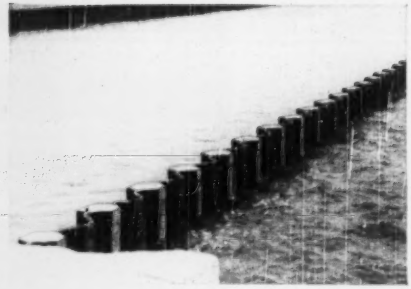

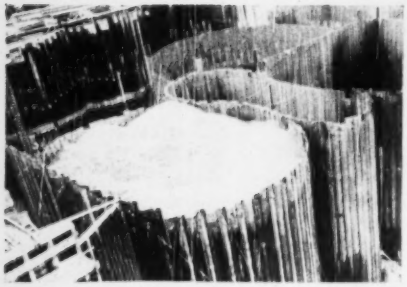

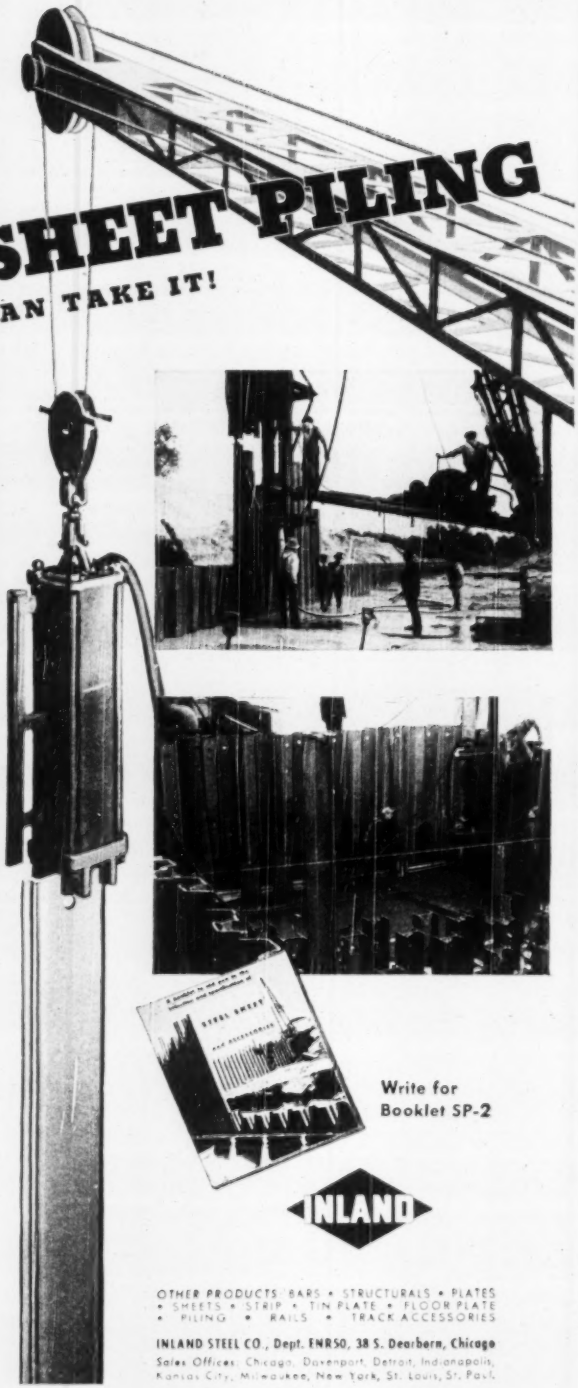

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CONSTRUCTION TRENDS

WHERE'S CONSTRUCTION GOING?

At its mid-year turning point, the construction industry is outrunning all predictions.

ENGINEERING NEWS-RECORD's figures show a 45% gain in contract awards. That's an increase of almost one-half over 1949—one of the biggest years engineering construction has ever had. Latest figures, broken down in detail, are given in column 3, p 28.

As yet, there are no signs of a letup in the volume of contracts coming in. But, with the industry operating at capacity, some tapering off is in the cards.

By all the signs, the industry will be working at capacity right through the year. With housing starts running 50% ahead of last year, and ENR's contracts almost 50% ahead, contractors will be working at full steam in completing the work already scheduled.

$25 BILLION PLUS

New light on just how big the industry is comes from the Department of Commerce's new estimates of total volume of construction of all kinds.

Coverage of these figures has been broadened. They now include the cost of improvements in land, such as drainage, and architect's fees and other charges that usually come in before work starts. Biggest single new item in private construction is an expansion of residential dollar volume figure to include major additions and alterations to older houses. A major change in reporting public work is to include atomic projects.

In 1950, by these new estimates, new construction as a whole will run to almost $26 billion. That is the value of materials and manpower put in place for all kinds of construction.

For comparison, the revised estimates put last year's volume at $22.6 billion. On the old statistical series, as Commerce has been reporting it, 1949 added up to $19.3 billion worth of construction.

In the light of last year's record, and with starts on new work running as they have been, $25 billion is a conservative figure for 1950 as a whole.

Biggest gain in construction, by types of work will be in homebuilding. It stands out, both in the government estimates and in ENR's contract awards. In addition, the figures as they are now set up include the value of major improvements in existing housing.

On Commerce's new basis, 1950's residential work will add up to a value of about $10 billion—about one-quarter larger than last year's figures. It will be, of course, the all-time record year for housing.

Percentagewise, the sharpest gain has come in private hospital and institutional building. Commerce's figures show it up 114%, in the first six months of 1950 over the first half of 1949. New private housing is up 55%, total new construction 17%.

BUSINESS BREAKS RECORDS

Paralleling the boom in construction, U. S. business is reaching new peaks. Industrial production, as measured by the Federal Reserve Board Index, has topped its earlier postwar peak, which level was reached in the fall of 1948.

Other businesses—retailing and construction, for example—are well above their 1948 levels. The steel industry has run steadily at better than 100% of its theoretical capacity—but steelmakers are no closer to catching up on orders than they were in the spring. Automakers have been producing more than 200,000 cars and trucks a week—and still dealers report they have long lists of customers waiting for new cars. Appliances, television, air-conditioning—and other lines—are also setting new records.

PARKING—NEW FACTS ON A GROWING PROBLEM

Comprehensive parking studies—done by the Bureau of Roads in 46 cities—have brought out striking facts on parking needs. They show directly how parking is geared to the cities' economic problems.

Some highlights: The larger the city, the fewer parking spaces it has for each one thousand residents. In the cities' central business districts, the parking problem grows directly as cities increase in size.

The studies found that in cities with less than 25,000 population, there were an average of 89 parking spaces for each 1,000 residents. In cities of 50,000 to 100,000 population, there were only 57 spaces. And in cities of over 500,000 population, there were only 12 spaces.

To put this another way: there were seven times as many parking spaces and thirteen times as many parked vehicles, per 1,000 population, in small cities as in large.

The studies measured the demand for parking spaces each hour in the concentrated core of the cities where most business is done. They found it was more than three times greater in large cities than in small. Demand for space, in relation to the supply of spaces, was more than three times as great in large cities as in small.

In short, parking is as much a city problem as are its utilities.

Obviously, the parking situation forced a different pattern of business on big cities than on small. The studies throw the first light on how great the differences are.

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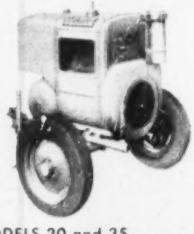

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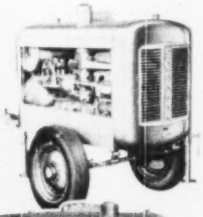

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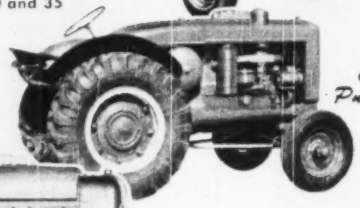

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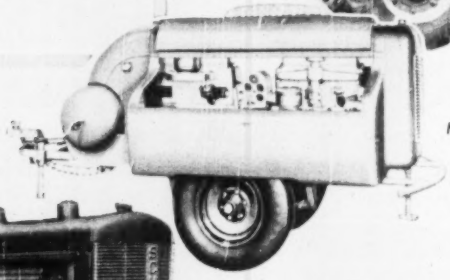

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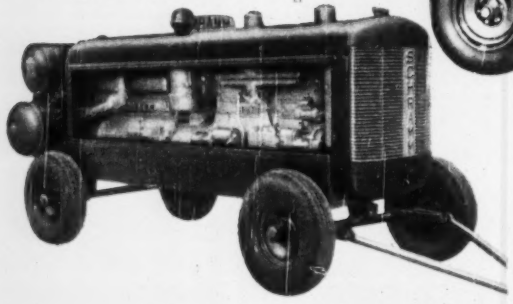

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New Reinforcing Bars

If you haven't used any of the new "improved" deformed bars in your reinforced concrete structures you had better look into the matter. Nearly all of the steel companies are rolling them, so they are readily available. The acceptance of their advantages—less steel, no hooks and better crack control—is so general among the experts you can hardly ignore this new product much longer without being at a competitive disadvantage. How this all came about forms fine testimony in support of the thesis that American technology is alive to improvements—and has the setup to put them on a sound basis quickly.

This particular example of the working of American technology began back in 1942. Clarence A. Willson, then head of the WPB's structural materials branch and sweltering in one of Washington's temporary war buildings, had a major problem on his hands: How to conserve our limited supplies of steel. The outcome was an emergency specification raising steel working stresses from 20,000 to 24,000 psi. But in the process Willson unearthed a particular headache in the concrete ship program; for the amount of concrete involved an unholy tonnage of steel was being used. The reason: unit stresses in the bars as low as 12,000 psi were required to limit the size and spacing of cracks in the concrete.

Pondering the dilemma thus created, Willson got an idea: find or develop a deformed bar whose projections would both limit end slip and create small closely spaced cracks instead of the large widely spaced ones that caused the boats to leak or deteriorate. Some test bars were rolled that showed great promise over the then standard deformed designs.

Here the steel companies themselves jumped in to help. Through their trade association, the American Iron and Steel Institute, they formed a research committee and went to work on the subject of bond and diagonal tension. It was soon evident that the size and spacing of the projections or deformations on the bars were the main elements in high bond resistance. First under the chairmanship of the late Roy R. Zipprodt and, after WPB, under Mr. Willson, the committee had various types of bars rolled and tested. Making the studies was Arthur P. Clark, and then Douglas E. Parsons of the Bureau of Standards came up with a definition of what a deformed bar should be.

The background was thus provided for a specification, and in 1947 the American Society for Testing Materials drafted and adopted one in tentative form. In June, 1949, it was made a full standard. Last week the ASTM put some finishing touches on it by designating sizes by numbers to do away with the odd size diameters that resulted from the deformations.

All this has taken place since the war. The beginning was some years before that, and it was these earlier events that unquestionably led Willson to spark his idea amid the chaotic climate of war preparations in Washington. Prof. H. J. Gilkey of Iowa State College in 1938 had made tests that threw considerable doubt on bond resistance practices. As chairman of the American Concrete Institute's committee on bond stress he carried his studies further, aided by Prof. Frank E. Richart of Illinois. Carl Menzel of the Portland Cement Association in 1939 raised questions as to the orientation of the deformations on bars, and his studies resulted in the marketing of the first of the new type bars. So, many people and many agencies have played a part.

The end of the story is that all steel companies are now busy converting from the old type deformed bars to the "improved" new ones, and changing their old square sections to rounds. Questioning and studies began a decade ago, but in the short span of five years, from 1942 to 1947, a stand was taken, a specification was drawn and manufacture of a new product began on a broad scale. Loose knit as the forces were emanating from individuals, trade associations, technical societies and government, they exerted themselves in a sure, sound manner without lost motion or direction. No dictator, no governmental fiat could have accomplished such a result. Democracy is best in the realm of technology, as it is in government. In this instance the user of concrete is the beneficiary.

Flood Control vs Power

A good example of the kind of misinformed thinking that makes necessary a clearly defined federal policy with respect to water resources is found in a proposal just made by the Steuben Rural Electric Cooperative Inc. of Bath, N. Y. It wants the new Mount Morris dam used for power development.

Mount Morris dam is being built on the Genesee River above Rochester as a means for controlling floods. No installation of power equipment is proposed at the present time since the operating plan requires the reservoir to be kept drawn down so that its maximum capacity will be available to store flood water.

Here again is the familiar story of people failing to see—or refusing to believe—that flood control and power are mutually exclusive. And Congress, lacking a clearly defined policy with respect to water resources, and having no broadly considered plan for each major river system, may yield to the appeal and direct a compromise. Part of the available storage at Mt. Morris Dam could, of course, be used for power purposes and part for flood storage, but only at sacrifice of some of the protection that the dam was designed to provide for communities downstream.

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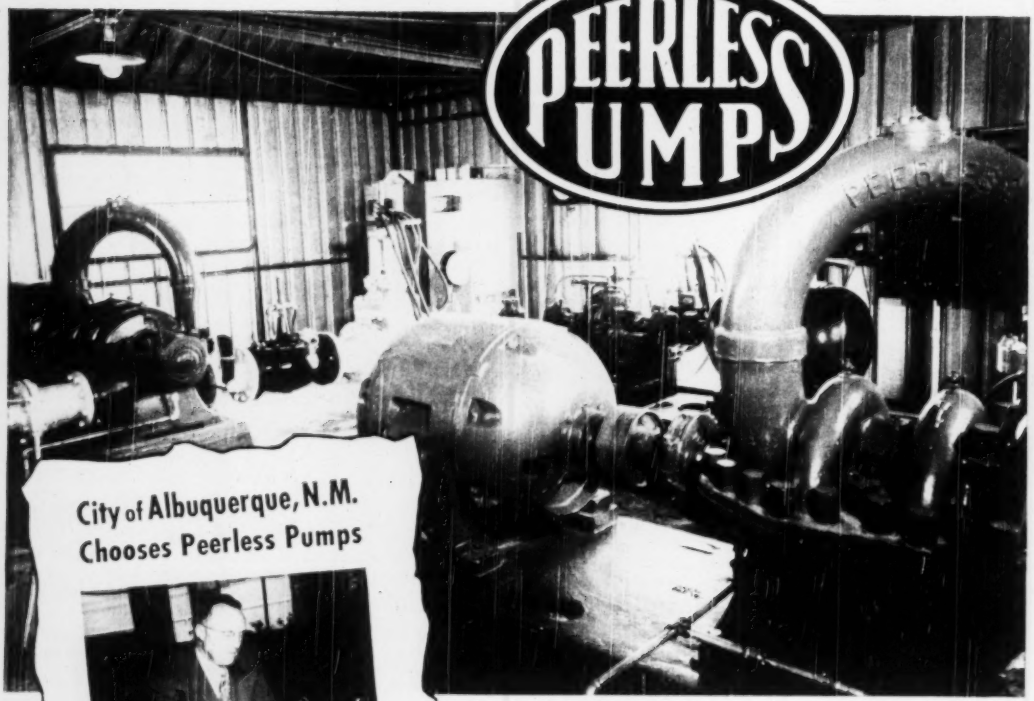

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Signed *Chas. Wells*
City Manager
City of Albuquerque, New Mexico

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ENGINEERING NEWS-RECORD

JULY 13, 1950 VOL. 145 NO. 2

Cooperation and research vital to stream cleaning

Industrial executives, regulatory men and university officials exchange pollution abatement viewpoints and explore technical problems at MIT conference

John C. Bumstead
Associate Editor

Efforts to abate stream pollution can't possibly succeed in the absence of two basic conditions. These are:

1. Thorough and effective cooperation between every agency, public or private, which is attempting to abate pollution; and

2. Effective research into specific problems of pollution abatement.

This was the consensus of delegates to the first New England Industrial Waste Conference. It was supported widely by industrial executives, plant engineers, state and federal officials, consulting engineers and chemists and university research men. Almost to a man, they called for such teamwork among abatement participants. And they were just as strong for careful study of all relevant conditions before abatement facilities are erected. Only thus can economical, effective waste treatment be achieved.

Samples of conference thinking on industrial waste treatment:

• **Jobs vs clean-up**—New England's economy depends heavily on paper and pulp, textile, leather and metal and metal-products industries. Their problems must be handled with considerable engineering genius, political tact and first-rate public relations. Waste disposal solutions that are difficult and expensive should be avoided. Unwise stream zonings should go.

All obstacles to industrial expansion and retention of industry must be overcome. Constant effort to this end will permit reasonable solutions to the industrial waste problem, to the ultimate benefit of all interests in the Northeast.—**R. M. Edgar**, assistant to the president, Boston & Maine Railroad, and Massachusetts chairman of the New England Council.

Vital as abatement is, it should not be so conducted as to imperil industrial expansion.—**O. D. Cay**, president, Cay Brothers Co., Cavendish, Vt.

• **Big job, many people**—Pollution abatement is a problem of such magnitude as to require all the skill and cooperation which can be brought to it. This can happen only in an atmosphere where compromise is possible.

There are seven state and federal agencies, plus several private organizations, interested in New England pollution abatement. Coordination of the activities of these public groups is vital. Without it, private groups can't participate, but only become strangled by red tape and interagency disagreement and confusion.

If public agencies can't cooperate harmoniously on coordinated programs, there's no point in attempting to enlist industrial effort in pollution abatement.—**W. S. Wise**, chief engineer, Connecticut Water Commission.

• **Industry lives with it**—If pollution is to be controlled successfully, industry and government must do the job jointly. It's one thing for a regulatory agency to determine the existence of pollution and a satisfactory abatement program. But the industry must operate the abatement facility. The agency will have a general knowledge of satisfactory treatment for many types of waste. But it must look to industry for intimate knowledge of the immediate problem. Such a situation must have cooperation.

A fuller cooperation between regulatory bodies and industry exists now. It's best exemplified by having business represented by chemists and engineers rather than attorneys. That's the most promising trend in stream pollution control today.—**J. A. McCarthy**, chief of laboratory, Massachusetts Health Department Experiment Station.

• **New tools**—Sanitary engineers must become familiar with and qualified to use new research techniques. Radioactive substances are applicable as tracers in water and waste studies, particularly where minute quantities—a few parts per billion—are involved.

While treatment processes for most domestic wastes are well defined and proved by long experience, many industrial wastes may require special processes not yet developed. Other wastes may require adaptations of known processes to be applicable economically to the treatment of discharged liquids.—**Rolf Eliassen**, professor of sanitary engineering, Massachusetts Institute of Technology.

The conference was sponsored by the New England Sewage Works Association, the New England Council and MIT. It was held at MIT.

Ohio asphalt business hangs on test

Toledo, the state of Ohio and the Standard Oil Co. of Ohio all are keeping an apprehensive eye on a new asphaltic paving mix formula known as T-50.

Toledo's interested because the new formula is under experiment as a possible replacement for another that worked successfully for years until a new batch of it virtually washed away on two Toledo streets.

Ohio's interest lies in the fact that it has been using the old formula, T-55—for 14 years—and is still using it on contracts already let.

SOHIO's interest is a cool 80% of the asphalt business for Ohio roads. It has been supplying 95% of all asphalt for this purpose. If T-50 becomes standard, it won't be able to sell more than about 15% of the total, a Toledo official estimated. Already it's lost some Toledo business to an Indiana supplier. He said SOHIO concedes that it can't meet the T-50 specifications because of processing difficulties.

Toledo's new T-50 formula calls for smaller stones and for 20% more asphalt than the T-55 formula. Toledo officials believe there's been a quality deterioration in the T-55 product even though that shipped today meets specifications by any statistical test.

State experts, who observed tests on T-55 samples, said they showed excessive disintegration as well as surface "raveling." Laboratory tests convinced them that the disintegration was due largely to low densities and possibly, in one case, to low asphaltic content.

A SOHIO official said the industry looks upon the T-50 formula as satisfactory so far as the crude-asphalt supplier is concerned.

R. K. Tomlin, former engineer-editor, dies

Served ENR, Engineering Record and Construction Methods and Equipment since 1909—Correspondent in War I

Robert K. Tomlin, editor of CONSTRUCTION METHODS and EQUIPMENT from 1927 until his partial retirement on account of ill health in 1945, died July 4 at New York. He was 64. Previous to his association with CONSTRUCTION METHODS, Mr. Tomlin served as a member of the editorial staff of ENGINEERING RECORD and ENGINEERING NEWS-RECORD for nearly twenty years. He was managing editor of ENGINEERING RECORD at the time of the consolidation of that paper with ENGINEERING NEWS in 1917, continuing as managing editor of ENGINEERING NEWS-RECORD.

Mr. Tomlin had the distinction of being the first engineer in this country to serve as a war correspondent. Soon after the United States went into World War I the publishers of NEWS-RECORD concluded that if the large part being played by engineers in that war was to be adequately reported, an experienced engineering editor would have to be sent to France as a correspondent. They found the Corps of Engineers receptive to the plan, and in December, 1917, credentials were issued to Mr. Tomlin and he left immediately for France.

• **Helped recruit officers** Mr. Tomlin's concise and well illustrated reports began to appear in ENGINEERING NEWS-RECORD within a few weeks. They brought to the readers a much clearer understanding of the many types of work in which American engineers were engaged in France than they had been able to get from newspaper accounts. The interest that they aroused helped in getting officers for new engineer regiments then being organized to meet a growing need in France.

Mr. Tomlin had not been in France many months before the need for experienced engineer officers caused him to apply for a commission. In September, 1918, he was commissioned a captain in the Corps of Engineers and assigned to the office of the chief engineer at Tours as officer in charge of the Technical Information section. Following the war, he returned to the staff of ENGINEERING NEWS-RECORD as an associate editor.

Mr. Tomlin was graduated from Harvard in 1907 with a degree of B.S. in civil engineering. He served first on construction of the Pennsylvania Railroad tunnels into New York. Later he joined the staff of New York City Board of Water Supply on the Catskill Aqueduct. He left that work in 1909 to join the staff of ENGINEERING RECORD.

During the early years of the American Road Builders Association, he took an active part in the work of that organization. More recently he has been active in affairs of The Mohs.

Robert K. Tomlin

Suburban sewerage plan brings Jersey test case

A test case which may have real effects upon suburban sewerage works in New Jersey was being prepared this week in two townships adjoining Trenton.

Two citizens of Lawrence, one of the townships, filed suit to halt the $4,200,000 project of the joint Lawrence-Ewing-Hamilton-Other Townships Sewerage Authority. With financial assistance of other residents of Lawrence's 5th voting district, these citizens won a preliminary injunction. (This voting district directly is served by the Trenton sewer system.)

That led the authority to ask each township for sufficient financial assistance to beat off the legal threat. Each side has threatened to appeal an adverse decision.

Attacking the suit, an authority official described it as "unjustified" and ill-advised." He said that considerable money had already been advanced by each township and more by Mercer County. Collapse of the project, he said, would be "catastrophic." He added that the authority expected it could win the case.

The opponents say that the increase in sewer charges from $12 to $35 yearly if the authority project goes through would constitute an improper tax on those already served by Trenton.

Falls water treaty faces Senate fight

Connally and Wiley oppose new pact boosting water diversions despite bipartisan and industry support

Despite strong endorsement from the private electric utility industry and state and federal power agencies, the treaty with Canada to permit more water to be used for hydroelectric development at Niagara Falls appears to face trouble getting approval.

Opposition from two influential members of the Senate Foreign Relations Committee popped up as the committee heard witnesses unanimously praise the treaty.

Chairman Tom Connally, Texas Democrat, expressed fear that the development of the Falls would permit the public "to be exploited."

The Texan later told one witness, "I'm not for this."

High-ranking Republican committee member, Senator Alexander Wiley of Wisconsin, also found fault with the treaty. He viewed it as a "final stab in the back" to the seaway.

• **No need to fear**—New York Senators Irving M. Ives, Republican, and Herbert H. Lehman, Democrat, both protested Wiley's contention and supported the treaty. Ives called Wiley's fears "without foundation."

Two of the American negotiators of the treaty testified in favor of it. Adlai S. Fisher, legal adviser to the State Department, said the new treaty offered a "permanent basis for long-term redevelopment."

E. Robert de Lucca, chief of the Federal Power Commission's Bureau of Power, declared, "In the light of international happenings recently, I think the availability of these water projects, such as Niagara Falls and the St. Lawrence waterway, will add immeasurably to our defense and materially to our production possibilities."

A report prepared by de Lucca last year was the basis for the treaty.

State support of the treaty came in a telegram to the committee from John Burton, chairman of the Power Authority of the State of New York. Urging approval of the treaty, Burton said that legislation will be asked in the New York State Legislature next year to incorporate Niagara in the Power Authority's jurisdiction.

Reasserting his company's position, President Earle J. Michold, of Niagara Mohawk Power Corp., asked ratification. Niagara Mohawk, he told the Senate committee, "is prepared to make the development as a private enterprise, and we can finance it."

He added that private development would add $25 million annually in local, state and federal taxes.

Delaware court OK's award to 2nd low bidder

A Wilmington, Del., jurist has upheld the right of the city's Board of Water Commissioners to award a contract to a second low bidder on a discretionary basis.

The board gave a $4,000,000 contract to the Henry E. Baton Corp., of Phila., on a bid $500 in excess of that submitted by the Carl E. Widell & Son Co., of Haddon Heights, N. J. A taxpayers' suit was brought to halt the award on the basis that it was a "gross abuse of discretion."

City attorneys argued that in the absence of bad faith or illegality by the board, the court should not impose its judgment on that of the board. The court agreed, holding that while the board might properly have investigated the low bidder more thoroughly than it did, the fact that it did not do so was no bar to the contract award.

"Sound discretion is reposed in the commissioners by the legislature," the court said in part, adding: "I particularly desire to emphasize that the duty of public bodies awarding work under statutes of the type here involved is of the highest, and no stones should be left unturned to evaluate a low bidder before his bid is rejected."

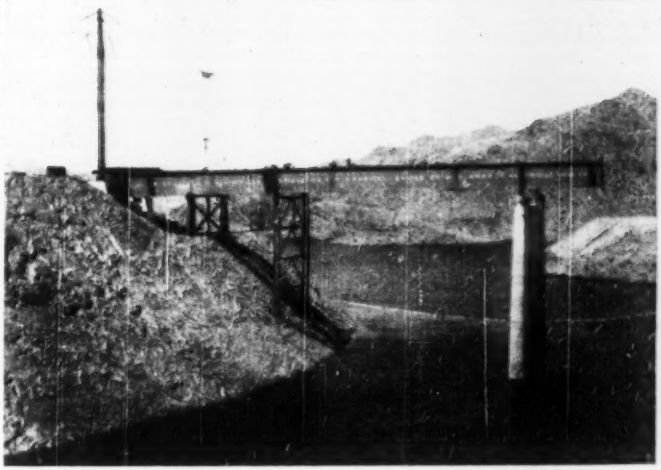
Await Ohio court rule on public housing taxes

Slum clearance in Ohio is awaiting a ruling of the Ohio Supreme Court on the tax status of public housing. If the decision is favorable, some 15 cities will be able to spend $200 million for 20,000 low-rent units.

This is the problem: In 1942, the state high court ruled that public housing projects could not be granted the partial tax-exempt status which is required by federal law. This law was revised a year ago by the Ohio legislature. But the federal government wants a ruling on the constitutionality of this law before advancing funds for Ohio.

A test case of the new law is to be conducted in Cincinnati, which has had a project of 2,850 units ok'd. The case should go to trial this fall, with a decision expected early in 1951.

While the litigation is pending, however, Ohio housing officials are making what preparations they can for the new program without spending federal money. In addition to Cincinnati, 14 other cities have federal allocations of dwelling units, including: Columbus, 2,200 units; Cleveland, 6,000; Akron, 2,000; Dayton, 1,500; Toledo, 1,500; Youngstown, 900; Canton, 700; Lorain, 585; Warren, Portsmouth, Hamilton and Mansfield, 500 each; Steubenville, 250; Elyria, 200.



DAVIS DAM CROSSING—This 420-ft continuous girder bridge will carry a highway across the forebay of Davis Dam, on the Colorado River between California and Arizona. Center pier breaks girder into two 210-ft spans. Steel bents are temporary construction supports. Maximum lift by the cableway was 33 tons and hand-operated crabs were used to lean the towers so the girders could be positioned precisely, according to Otto Schultz, American Bridge Co., superintendent.

FPC gets Texas-Canada pipeline plea

Pacific Northwest Pipeline Corp. has applied to the Federal Power Commission for authorization to build a 2,175-mile pipeline system.

The line would bring natural gas to the Pacific Northwest for the first time. Originating in Wharton County, Texas, the line would run to Washington and Vancouver, Canada. The company estimates the cost to be $174,186,602.

Plans call for 2,175 miles of 26-in. line. The company also plans 400 miles of 22-in. and lesser size lines. These would be lateral lines, needed for the gathering, distribution and sale of the gas.

The main 26-in. line would supply 250 million cubic feet daily. The company also plans to purchase 100 million cubic feet daily at or near the U. S.-Canada boundary between Idaho and Canada. This gas would come from the Alberta field. The amount equals the ultimate needs of the Vancouver market, according to the application.

Sales areas listed in the application are as follows: Utah: Salt Lake City area; Idaho: Snake River area, including Pocatello, Idaho Falls, Twin Falls, and Boise; and the Kellogg and Wallace area, including Sand Point, Bonner's Ferry, Eastport, and the atomic energy plant, including the Moscow area; Washington: Spokane area, Hanford area (including the atomic energy plant), Seattle area and Tacoma area; Oregon: Portland area; Canada: Vancouver area.

Pa. Turnpike revenues up

Revenues and traffic continued to increase on Pennsylvania's Turnpike during the fiscal year ended May 31. Revenues were up 21.97%—to $7,713,806—over the last previous fiscal year. Passenger vehicles using the roads were up 7.1%—to 2,077,774, the Turnpike Commission reported. Trucks on the 161-mi. road increased 22.6%—to 940,754. Opening date for the 100-mi. eastern extension continues to be set for next Oct. 1.

Cleveland bond vote set

Bond issues totaling $18,600,000 will be voted on by Cleveland residents this fall. They represent numerous projects which were voted on last fall and which barely fell short of the necessary 65% majority then required for approval. Under a new law, the issues will require only a 55% majority this year. Parks, a freeway, sewerage, off-street parking, paving and service buildings are included in the program.

Denham OK's construction hiring hall

Further evidence of the confusion that construction industry labor relations cause government agencies (ENR June 29, p 22) came in three developments recently.

1. General Counsel Robert Denham indicated the type of labor hiring hall he will approve for construction workers;

2. NLRB refused to take jurisdiction in a secondary boycott charge against an AFL glaziers' union at Joliet, Ill; and

3. It was indicated that the Bureau of Labor Statistics may change its reporting of jurisdictional disputes.

• **Hiring Hall**—Indication of Denham's feelings about union hiring halls came when the general counsel's office refused to issue a complaint against a union hiring hall operated by the Nampa Building Trades Council at Nampa, Idaho. It was apparent, from the refusal, that since Denham is not holding elections in the construction industry, he will not issue unfair labor practices charges stemming from a union shop arrangement not validated by a union shop poll.

In the Nampa case, a worker charged that, because of the hiring hall, the AFL Carpenters union was able to deny him a job with a contractor building a state school. But the general counsel's office called attention to the fact that investigation of the Nampa hiring hall shows no case of discrimination against any non-union personnel under an agreement, the hiring hall serves union and non-union labor, all contractors taking them men from it, unless none are available, the union-shop election is not necessary.

• **Secondary boycott**—NLRB said it will not consider ending a secondary boycott of the AFL Glaziers' union against pre-glazed sash in Joliet, Ill., because it feels that the operations of the contractors involved are essentially local in character.

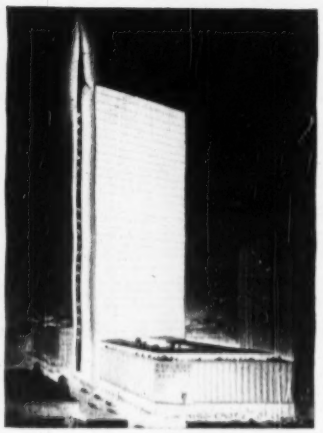
Dismissal by the board of secondary boycott accusations terminates an injunction issued in November, 1948, by Denham. NLRB's trial examiner found the union guilty of secondary boycotts in three instances in two of which workers walked off their jobs when they found some pieces of pre-glazed sash—and the union did not deny that its constitution prohibits members from glazing in any warehouse.

But NLRB did not consider whether any law was being violated; it simply found that the operations affected were local and not worth federal intervention.

• **Statistics**—The Bureau of Labor Statistics, which has been publishing statistics on jurisdictional strikes in construction, found its figures challenged by no less an authority than John T. Dunlop, head of the National Joint Board for Settling Jurisdictional Disputes in the construction industry.

In an article in the Harvard Economist, Prof. Dunlop said that BLS statistics are "completely unreliable" because of the incompleteness of the agency's reporting system. (BLS gets its strike information by following up with questionnaires those strikes reported in newspapers, union and trade publications, and by state and federal conciliators. It limits its coverage further by requiring that a stoppage involve at least 6 workers for at least one full shift.)

Prof. Dunlop revealed that, while BLS was reporting only 16 jurisdictional stoppages over the last eight months of 1948, the Joint Board recorded 58. During 1949, the Joint Board listed 238 stoppages, BLS 75.



DALLAS' FINEST—Tallest building in the Southwest—that's how Dallas' Republic National Bank describes this structure it will build. It will be 440 ft high and have a 160-ft tower, cost $15,000,000, will be air conditioned throughout and be completed late in 1952. Harrison and Abramovitz, New York, are architects. Associated with them are Grayson Gill and George E. Harrell, Dallas.

Military engineering enters cold war

An ancient military tactic—destruction of key installations to impede an advancing enemy—has become a propaganda weapon in cold war.

The transformation came to light recently when a German picture magazine published a story about Allied preparations to blow up a winding highway around the tabled Loreley cliff, overhanging the Rhine. It published pictures showing a series of holes being sunk into the road, then capped with concrete. These holes would be filled with dynamite which, detonated, would drop the road into the Rhine. American Occupation Headquarters declined to comment.

By way of confirmation, the Associated Press quoted "a French source in the Coblenz area" as asserting:

"It is not only this road on which such measures are being taken and it is not only the French who are making such preparations. It was the Allied high command ordered this."

Asked whether the holes were defense measures, this source added:

"I want you to know that these measures are being taken not only in the French zone and along the Rhine, but everywhere in western Germany. It would be best to say nothing about this."

• **That tore it**—Some days later, U. S. High Commissioner John J. McCloy conceded that preparations were being made to blow up strategic locations in case of "an aggression from the East," according to the NEW YORK TIMES. That was enough to transform military demolition into propaganda.

For the Communists, according to the Times, immediately summoned their west German supporters to demonstrate at the Loreley rocks against the mining. They charged that the real reason for the potential demolition is "to leave a heap of rubble in Europe when they (the Allies) retreat from the continent, as they expect they will." Consequently, the Red propaganda contended, "tens of thousands must flock to the Loreley next Sunday by rail, ship, bicycle and on foot, firmly resolved to protect their beautiful homeland against the gunpowder plot by the Atlantic generals."

• **Conventional design**—In the case of bridges, according to the AP, any such demolition preparations would be less difficult than those affecting the roads. Most European countries build bridges with chambers where dynamite may be placed to destroy them promptly in case of war, AP says.

Such chambers in piers of bridges across the Lahn River, at Bad Ems, Germany, were sealed on French orders at the war's end. But pictures in the German magazine which broke the story purported to show that these chambers have been unsealed and steel ladders put into them.

CONSTRUCTION BUSINESS

Most contractor failures caused by inexperience or incompetence

Analysis of contractor failures in the past nine months shows that inexperience accounts for 49% of all failures, incompetence for 34%.

Most frequent underlying causes of failure, as determined by a Dun & Bradstreet study for the period July, 1949–March, 1950 are:

1. Incompetence—One third of contractor failures. (It is the cause of 39 to 40% of manufacturing and wholesale failures.)

2. A little over one fourth of contractor failures is due to lack of managerial experience. Contractor failures are 27% (compared with 19% for manufacturing, 18% for wholesale businesses and 22% for retail trade.)

3. Lack of construction experience causes only 13% of construction business failures. (Lack of experience in the business line is charged with 20% of manufacturing and 25% of retail business failures.)

The failure of a contractor is most likely to show up in his inability to avoid one or more of the following conditions: Inadequate business volume, heavy operating expenses, accounts receivable difficulties, or competitive weakness. These are "apparent" causes of failure, not the underlying causes, according to D & B.

Heavy operating expenses and receivables difficulties are twice as deadly in construction business as in other lines, except wholesaling. Inadequate business volume, on the other hand, has been only half as fatal to contractors as to other lines of business—in the past nine months.

These facts and the supporting figures cover all kinds of construction contractors, including subcontractors. The contractor failures for the first five months have been distributed: 31% general building contractors, 64% building subcontractors, and 5% other contractors. The failure diagnosis is not available separately for these three types of contractors.

Contractors failing during the period analysed had average current liabilities of $20,915 and total liabilities of $31,495.

Contractor failures exceed 1949 rate

Contractor business failures in April and May continue to occur at about the same rate as in the first quarter. Total number of failures is running about 17% higher than the first five months of last year, but only 8% over the average for all of 1949. The five-month total of 380 failures is an average of 76 a month, according to Dun & Bradstreet.

Failures among general building contractors this year range from 20 to 24 failures a month, compared with a 1949 average of 27; building subcontractor failures at 47 to 52 a month compare with a 1949 average of 59; and failures of other contractors at 2 to 8 a month (but an average of 4 compare with last year's average of 5 a month.

Construction Business Failures—1950

Type of contractor	No. of failures Jan.-Mar. average	Apr.	May	Jan.-May total
General bldg. contractors	24	24	29	119
Bldg. sub-contractors	47	50	55	241
Other contractors	4	2	8	19
Total	75	76	80	380

• **Surety losses up**—While there has been no jump in contractor failures recently, surety losses are increasing, relative to value of bonds put up, according to reports by surety companies to the Bureau of Contract Information. That is, the relation of surety company losses to their earned premiums has been rising.

July cost indexes up 1% over month ago

July rise is only half that of June; lumber prices account for most the increase, wage rates for the rest

The ENR Construction Cost Index for July is up 1% or 3¼ points over June to $111.91 (1913 = 100). The Building Cost Index is up 1% or 4 points to 376.90. This is about half the June rise of 10 and 8 points respectively.

The Construction Cost Index is up 5½% since January and 7% since a year ago. The Building Cost Index is up 5.7% from January and 8% from a year ago.

Of the 3¼-point July increase in the Construction Cost Index, lumber prices account for 3¼ points and common labor wage raises for 2 points. Of the 4-point Building Cost Index increase, lumber prices account for 3½ points and skilled wage raises for only half a point.

Common labor this month in 20 cities is up an average of 1 cent or 0.7% over last month to $1.535 an hour. This is 5.3 cents or about 4% over January. It is 7.3 cents or 5% over a year ago.

Skilled labor is up less than 1 cent over last month to $2.524. This average wage of skilled workers in 20 cities is 6 cents or 2% over January. It is 11.1 cents or almost 5% over a year ago.

Lumber prices average $93.28 a thousand this month in 20 cities—up 4% or $3.13 from June and 20% or $15.17 over January.

Cement this month is steady at $2.97 a bbl. (20 cities average). Structural steel is also steady at $3.40 a cwt (3-mill average).

Causes of Business Failures—July, 1949–March, 1950

Construction and Other Businesses

UNDERLYING CAUSES	Construction	All business	APPARENT CAUSES	Construction	All business
Neglect	7.5%	6.3%	Bad habits	1.5%	1.7%
other			Poor health	3.2	2.4
			Marital difficulties	2.2	0.6
			Other	0.9	1.1
Fraud	1.5	3.4	Misleading name		0.4
on the part of the principals			False financial statement	0.7	0.2
reflected by			Poor selection of location	0.7	0.2
			Irregular disposal of assets	2.6	2.6
			Other	0.5	0.4
Lack of experience in the line	12.5	21.5	Inadequate sales	23.5	12.0
Managerial experience	27	20.9	Heavy operating expenses	21.5	13.1
			Receivables difficulties	15.7	7.5
Unbalanced experience	3.0	6.6	Inventory difficulties	4.1	10.9
Incompetence	48.6	34.5	Excessive fixed assets	0.6	12.5
			Poor location	0.6	0.2
			Competitive weakness	19.2	11.5
			Other	9.5	5.4
Disaster	1.1	1.9	Fire	0.5	0.5
			Flood		0.6
some could have been insured against			Burglary	0.1	0.2
			Employees' fraud		0.3
			Strike	0.7	0.5
			Other	0.4	0.4
Unknown	3.8	1.5			
	100.0	100.0			

Source: Dun & Bradstreet, based on opinions of informed creditors and information in Dun & Bradstreet's credit reports.

BIDS AND BIDDERS

(Major project news received after Construction Reports, page 92, went to press)

Pipe Line—Fish Pipe Line Construction Co., Chicago, Ill., has been awarded $11.7 million contract by Peoples Gas, Light & Coke Co., Chicago, Ill., to construct 1,254 mile 30-in. welded joint natural gas pipe line from Texas through Arkansas, Missouri to vicinity of Joliet, Ill.

New Jersey Turnpike—Construction Aggregates Co., New York, N. Y., and Peter Kiewit & Sons', Omaha, Neb., were low bidders at $5,839,373 for constructing Section of Turnpike in Union and Essex Counties, which New Jersey Turnpike Authority, Trenton, opened bids July 6. Edwards & Kelcey, Frederic R. Harris, Inc., and O. J. Porter & Co., Newark, are consulting engineers.

Housing—City of Baltimore Housing Authority, Baltimore, Md., plans to build housing at about $9,000,000.

Cachuma Dam—Bureau of Reclamation, Goleta, Calif., received $6,717,000 low bid July 6 for constructing Cachuma Dam on Santa Ynez River, Santa Barbara, Calif., from Mittry Construction Co., West Los Angeles.

Schools—Voters of Fresno Unified School District, Fresno, Calif., approved $9,925,000 bond issue to construct two junior high schools, one senior high school and several elementary schools.

Office and Airport Buildings—Thomas S. Byrne, Inc., Fort Worth, Tex., has been awarded several contracts in Fort Worth, including $5,000,000 office and bank building for Fort Worth National Bank, Shreve, Lamb & Harmon Associates, New York, N. Y., and Preston M. Geren, Fort Worth, archts. Award was also made to Byrne organization for office and hangar at Greater Fort Worth Airport, by the American Airlines. Fourth Worth at $2,000,000, as well as airport administration building to-added by City of Fort Worth, at same location to cost $2,000,000. J. R. Pelsh and P. M. Geren, Fort Worth, are architects on both airport projects.

Department Store—Hecht Co., Arlington, Va., plans department store at Arlington to cost $2,500,000. Albert, Merkt & Co., New York, N. Y., are architect-engineers.

Housing—Bids will be opened July 20 for two housing projects by the City of Hoboken Housing Authority, Hoboken, N. J. Cost will be about $7,000,000. Ricker & Axt, West New York, N. Y., are architects.

Friant-Kern Canal—Peter Kiewit Sons' Co., Delano, Calif., has been awarded $3,333,156 contract for earthwork, concrete lining, and structures for Friant-Kern Canal, Central Valley Project by Bureau of Reclamation, Friant, Calif.

Reservoir—City of Asheville, N. C., plans reservoir for supplementing water supply to cost $3,000,000.

Dwellings—J. C. Nichols Co., Kansas City, Kan., will construct dwellings by own forces in Johns County, near Kansas City. Estimated cost is about $5,000,000.

Hospital—Euclid Glenville Hospital, Euclid, O., will open bids August 8, for constructing hospital at Euclid, O. Cost is about $3,000,000 and Conrad, Hayes, Sampson & Ruth, Cleveland are architects. J. E. Fierbaugh, Cleveland is engineer.

Housing—John A. Johnson Sons, Inc., Brooklyn, N. Y., will build housing for the Stamford Housing Authority, Stamford, Conn., at $3,543,000. William E. F. Ballard, New York, N. Y., is architect.

Residences—Homewood Company, Columbus, O., will construct 400 residences in Lorain, O., by separate contracts to cost about $3,000,000.

Military Housing—J. C. Boespflug Construction Co., and S. Birchard Sons, Seattle, have been awarded $3,175,000 contract for military housing at Fort Richardson, Alaska. U. S. Engineer, Seattle, head the project.

Diablo Dam—City of Seattle, Seattle, Wash., awarded contract for grouting and spillway extension for Diablo Dam at City Light plant to Morrison-Knudsen Co., Inc., Boise, Idaho, at $2,000,344. L. R. Hotchkiss is city light superintendent.

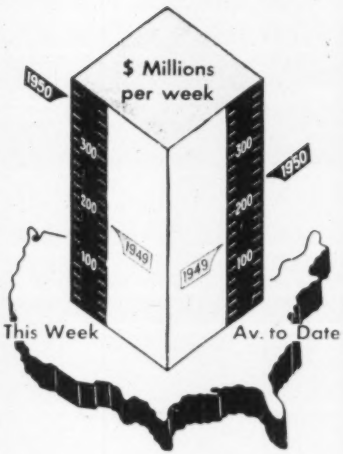
School—Board School Commissioners, Indianapolis, Ind., will take bids August 25, for Manual Training High School, in Indianapolis to cost $3,000,000. A. D. Bohlen & Son, Indianapolis, are architects.

Library—Gust K. Newberg Construction Co., Chicago, Ill., was low at $2,283,700 for constructing Memorial Library on campus of University of Wisconsin, Madison, Wis. Philips & Ellis, Milwaukee are architects. R. C. Kidwell, Madison is state architect.

COSTS AND VOLUME

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	July '50	211.91	246.97
Building Cost	July '50	226.99	260.74
Volume	June '50	427	387



Activity This Week

As reported to ENR (in millions of dollars)

Amount of contracts let

Week of July 13, 1950	This Week (28 wks.)	Cumulative 1950 (28 wks.)	Cumulative 1949 (28 wks.)	% chge
Federal	$12.7	$702.7	$625.4	+12
State & Mun.	68.4	1,365.1	1,611.6	−15
Total Public	$81.0	$2,615.8	$2,237.0	+17
Total Private	25.0	1,092.6	1,098.8	−1
U. S. Total	$106.0	$3,711.4	$3,335.8	+11

Contracts by type of work

	This Week	Cumulative 1950 (28 wks.)	Cumulative 1949 (28 wks.)	% chge
Waterworks	$1.3	$57.6	$59.3	−3
Sewerage	2.3	124.6	114.6	+9
Bridges	3.1	209.5	183.9	+14
Highways	25.0	677.2	666.7	+2
Earthwork				
Waterways	21.7	270.9	220.9	+23
Industrial				
Public	26.8	842.8	1,004.1	−16
Private	11.8	324.2	228.1	+42
Housing	7.5	2,611.6	2,329.9	+12
Public	4.1	1,769.4	1,325.8	+33
Private	3.4	842.2	1,004.1	−16
Commercial	10.6	340.9	332.7	+2
Unclassified	12.1	432.9	367.0	+18

SOURCE: Municipal-type projects included are: waterworks and wastewater projects, $25,000; other public works, $50,000; industrial and large (over $50,000) private buildings, $250,000.

New capital for construction

	Cumulative 1950 (28 wks.)	Cumulative 1949 (28 wks.)	% chge
Corporate Securities	$1,363.4	$1,005.5	+36
State and Municipal			
Total	1,577.9	1,234.1	+28
Federal	1,311.9	1,053.4	+24
Housing	266.0	180.7	+47
Total Capital	$2,739.5	$2,287.8	+20

Question builders' contract discretion

Boston Finance Commission charges contractors, city overstepped on interpreting building contracts

Another contracting scandal has erupted in Boston.

This one alleges inferior pointing and waterproofing on 17 city schools. The Finance Commission has filed a 17-page report with Mayor John B. Hynes criticising severely the interpretation of the specifications by various contractors.

Total cost of the work, as provided in 16 contracts and one work order, is about $145,000. Mayor Hynes forwarded the report to the Board of Commissioners of School Buildings.

• **Incomplete performance**—Contracts were awarded last summer under a different city administration. Fin Com found that in most cases the work was not done to the extent specified by the contracts. It suggested that contractors be required to complete performance or that the city enforce its rights. Its report asserts:

"The interpretation by the officials of the School Buildings Department of the meaning of the specifications on which bids were sought created a situation which was wide open to fraud and collusion."

But Fin Com adds that contracts appear to have been drawn carefully and to have spelled out in understandable language what the requirements were.

For some months, Fin Com has been reporting to the city on improper execution of highway contracts. ENR June 22, p 30.)

Dispute over the meaning of a contract arose on the first job. When the contractor encountered brick in good condition, he contended that it was neither necessary nor good judgment to disturb it, despite contrary requirements appearing in the contract.

• **Official relaxes terms**—The city construction superintendent then ruled that only such work be done which was necessary to render the building waterproof. This became policy on subsequent jobs.

Contracts, though, required cutting out, repointing and waterproofing of entire areas of walls as described in work sheets. Fin Com questions how long it will be before leaks develop because of the quality of some contractor's work.

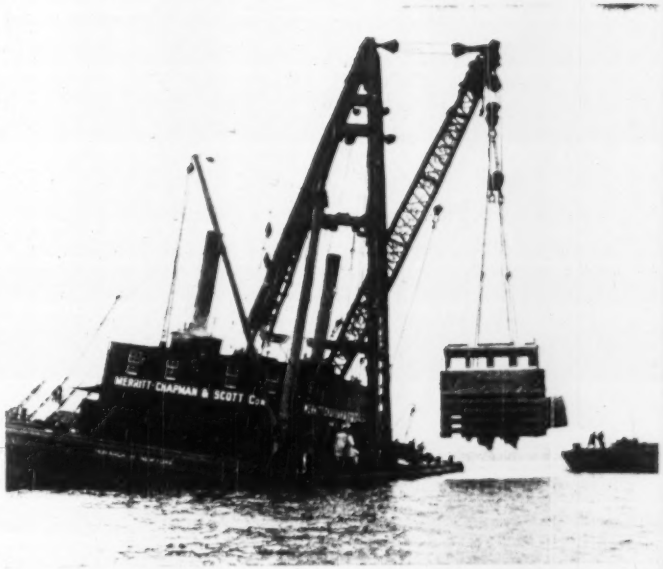
Contractors who bid seem not to have had a common understanding of the work required. On some jobs the low bidder's price was about one-third of the high bidder's. On one job, it was one-fifth. Key to this situation lies in the contention of the construction superintendent. He says that, regardless of contract wording, it was necessary that the city inspector determine what should be done. Had the superintendent or inspector required that every course of brick or stone facing be removed and newly mortared in, each job might have required months, rather than a few weeks or days.

Fin Com charges bad judgment in applying to all jobs one general specification. It alleged insufficient inspection of the needs at each building. It reported that trouble arose from differences in judgment between the construction superintendent and the inspector, that supervision was insufficient; and that the superintendent was not justified in his interpretation that contracts referred only to spots designated by the inspector.

• **How to frame a contract?**—Fin Com recommended that something be done about the way such contracts and bid proposals are drawn. If proposals require reputable bidders to assume they'll have to furnish more labor and materials that a city official secretly has in mind, Fin Com argues, the resulting bids will be far more than a fair price for the work the city wants done.

Conversely, if reputable contractors learn that there are unwritten reservations—which would allow a profit on a job that, literally performed, could only bring a loss—such contractors won't bid.

So Fin Com wants no more proposals so framed as to indicate the need for more labor and materials than the city will insist upon. If the exact amount of each can't be specified, Fin Com suggests bid invitations specify unit prices.



RUSH JOB—Hudson intake crib was lowered into place off the river's east bank near Chelsea, N. Y., June 14. Merritt-Chapman & Scott's 250-ton floating derrick Monarch set the 145-ton structure down on a timber pile foundation. There it will take 100 mgd from the river to supplement New York City water supply in times of dire emergency. See ENR June 29, p 33 for details of the intake and pumping plant.

Mortgage buying, selling transferred from RFC

The Federal National Mortgage Assn. (Fannie Mae) was transferred last week from the Reconstruction Finance Corp. to the Housing and Home Finance Agency.

The move came in connection with another administrative reorganization under which RFC itself would have lost independent status and have been transferred to the Commerce Department. That part of the plan was rejected on the basis that a Senate committee is still carrying on an investigation of the huge lending agency. A second try at switching RFC may be made when the investigation has been completed. Fannie Mae had become RFC's largest single operation.

Single Pumping and Generating Unit Built for Pumped-Storage Hydro Plants

Design for a single unit that can be used both as a pump and as a power generator have been developed at the plant of the Allis-Chalmers Manufacturing Co. in Milwaukee.

The development is a result of studies of what happens in a centrifugal pump when power fails in a system in which static head predominates. Tests conducted on these pump-turbine units have shown such satisfactory efficiencies when operating either as a pump or as a generator as to indicate large savings over those obtained in power plants where separate pumps and hydraulic turbine-generators are used.

The pumped-storage system of supplementing the output of hydroelectric power plants has been used extensively in Europe, over 1,000,000 hp having been installed between the two world wars (ENR April 29, 1948, p. 85). In such plants, off-peak power from a low-head plant on a large river is used to pump water into a relatively small storage reservoir high in the nearby hills. From the reservoirs the water is drawn during peak-load periods, returning to the river through high-head turbine-generators.

The only plant of this type in this country is the Rocky River plant in Connecticut, but it operates on a seasonal rather than a daily basis. It pumps water from the Housatonic River when the river is in flood and returns it to the river during seasons of low flow, to supplement the output of the plants downstream.

The cost of installing both pumps and hydraulic turbines in such plants has limited the wider application of this system, especially in this country.

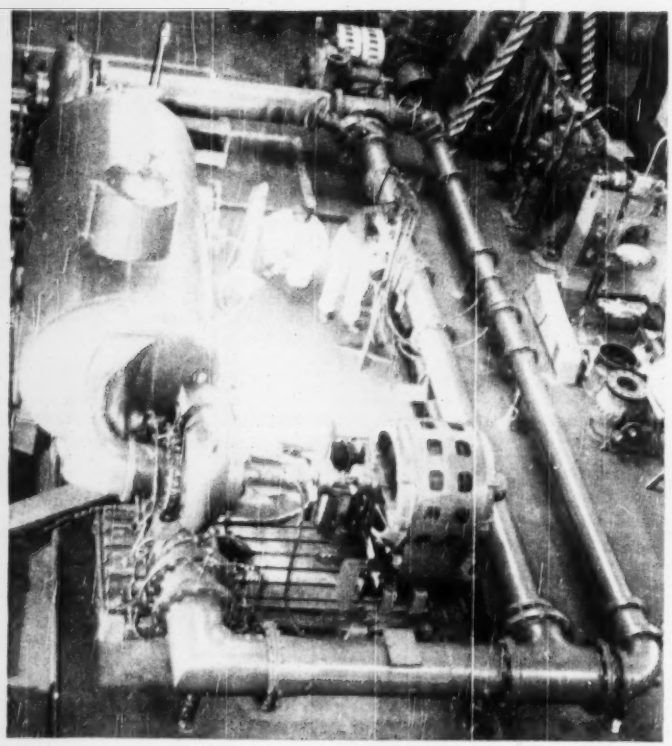


Fig. 1. TWO IDENTICAL UNITS under study in the test loop at the Allis-Chalmers plant. The one in the foreground is pumping, and the one at the upper left is acting as a turbine. The output of the latter is measured by a hydraulic brake, not in the picture. Power input is measured by a calibrated motor, and the various heads are measured by water or mercury manometers or by gages. Capacity is measured by a venturi meter.

• **Research work**—In the research work at the Allis-Chalmers plant, two identical pump-turbine units were built and tested on the same circuit, as shown in Fig. 1. Each consists of a suction nozzle, a medium specific speed runner, adjustable guide vanes around the runner's periphery, fixed stay vanes outside of these and a volute casing. Introduction of the variable guiding apparatus helped in fitting the pump-turbine to both purposes.

The specific speed of the test unit acting as a pump at the designed gate opening is 4,250 on an rpm, gpm, foot-head basis, or 1995 on an rpm, cfs, foot-head basis. Its specific speed as a turbine at the same gate opening is 515 on an rpm, hp, foot-head basis.

The head required by the turbine at a given gate opening is higher than that developed by the pump at the same gate opening. This makes it necessary to rely on the gates to improve the fit of the pump-turbine to the system in which it is operating. Running the pump at higher speeds than the turbine also would provide a means for fitting the unit to the system.

• **Operating the pump-turbine**—At the start of a pumping cycle when these units are used as part of a pumped-storage system, the storage reservoir will be at its lowest level, hence pumping starts against the lowest head. This will be true also at the pumping effects the level of the suction pool. When generating starts, on the other hand, the head will be at its maximum.

For a given static head, the runner will discharge more water per second than it will discharge when operated as a pump. Consequently, at the generating period is 5 hours in a 24-hr. day, the corresponding pumping period may have to be 8 or 10 hours to refill the storage reservoir. To make such pumping practicable the unit should be operated as part of a truly large sys-

tem that can supply the power for this larger pumping period at a much lower rate per kilowatt than the rate for which power can be sold when the unit is generating.

When generating, the unit should be used at its optimum efficiency corresponding to the variations in net head in order to obtain the largest total output of kilowatt-hours. Conspicuously, such pump-turbine units should be used to supply prime load rather than for regulating.

• **Performance of the unit**—Performance curves for a typical installation of one of these pump-turbine units are given in Fig. 2. They are for a unit designed to supply 5,000 kw at 163.6 rpm for an 8-hr period operating under a static head ranging from 90 ft, at full storage pond to 60 ft, when the pond is empty.

Assuming a friction loss of 3 ft at the start of the generating cycle and 2 ft at the end, the net head will range from 87 to 58 ft. The expected output at the beginning will be 6,750 kw at 0.9 power factor and a discharge of 1,100 cfs with a turbine efficiency of 87% and a generator efficiency of 96%.

At the end of 8 hours the output will be down to 3,450 kw and the discharge to 910 cfs. The average output will have been about 5,100 kw, or a total of 40,800 kwh, and the water consumption will have averaged 3,040,000 cu ft per hour, which would require a reservoir of 600 acre-ft capacity.

When the change-over is made to the pumping cycle, friction losses will increase the dynamic heads to 63 and 92 ft, respectively, and the discharge will range from 1,150 cfs at the start to 750 cfs at the end. The average rate, therefore, will be 3,380,000 cu ft per hour, as against an average of 3,040,000 used for generating, which means that pumping will have to be continued for nearly nine hours to refill the reservoir. This will require 63,600 kwh at 1.0 power factor, which the motor is assumed to have an efficiency of 96%.

• **Possible savings**—How the pump-turbine could be operated profitably is illustrated by the following situation: A unit is required to supply 5,000 kw at 163.6 rpm for an 8-hour period. There is a static head of 90 ft between full-storage level in the pond and the lower level of the suction pool when it is drawn to its lowest level. With an average of 9,700 brake horsepower required, pumping for 8.55 hours would consume 82,700 kwh, or 65,600 kwh at 1.0 power factor. At 4 mills per kilowatt-hour, the total cost for pumping would be $254.40. Power generated by the stored water would total 40,800 kwh, and at this would be sold for 1.25 cents per kilowatt-hour in peak load periods, it would be worth $510—a ratio of return of about 200 percent.

• **Special requirements**—Pumped storage hydroelectric plants will require electrical equipment of the same general nature as is now used in generating stations or pumping plants, according to Allis-Chalmers engineers. They indicate that special requirements of the application can be met without excessive development or unreasonable cost. Although the pump-storage plant will generally require more electrical equipment than a comparable generating plant, some features, such as voltage regulation and pilot excitation, usually considered necessary in a generating plant, might actually be eliminated in the pumped storage plant.

In comparison with a generating station, the chief differences arise from the necessity of starting and operating the synchronous machine as a motor, with the direction of rotation opposite to that required when it operates as a generator. The major electrical problem in designing the plant is that of motor starting, says Allis-Chalmers engineers, who favor installation of a compressed air system to permit starting the pump unwatered.

The information required in specifications for a pumped storage plant would include the following: elevation of suction pool with pool filled; approximate drawdown of pool in feet during pumping cycle; elevation of storage reservoir with water at lowest level at beginning of pumping cycle); elevation of storage reservoir with water at highest level at end of pumping cycle); size and length of penstock to be used from storage reservoir to pump turbine; estimated friction loss in the system; and output per unit in kilowatts desired over the average generating period of 8 hours. The manufacturer would determine the size of unit required, specify the rpm, and furnish expected performance curves for generating and pumping with the head range indicated by pool elevations.

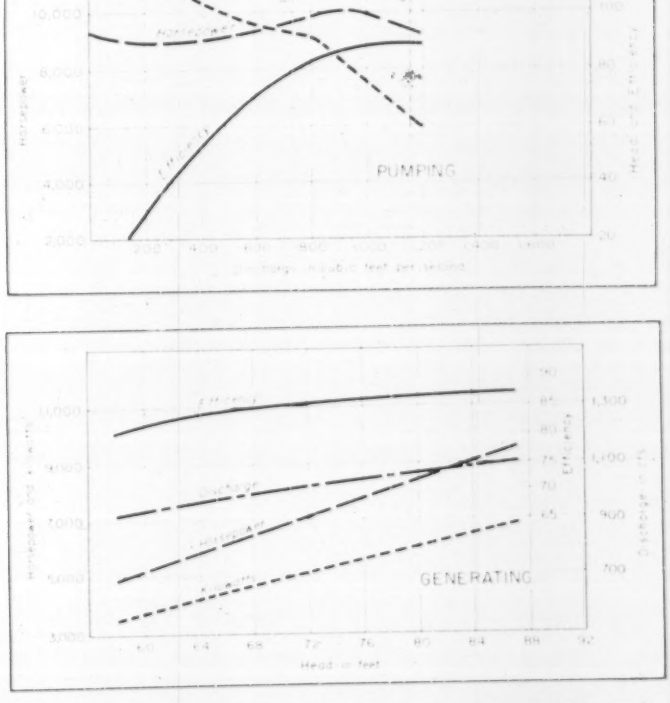
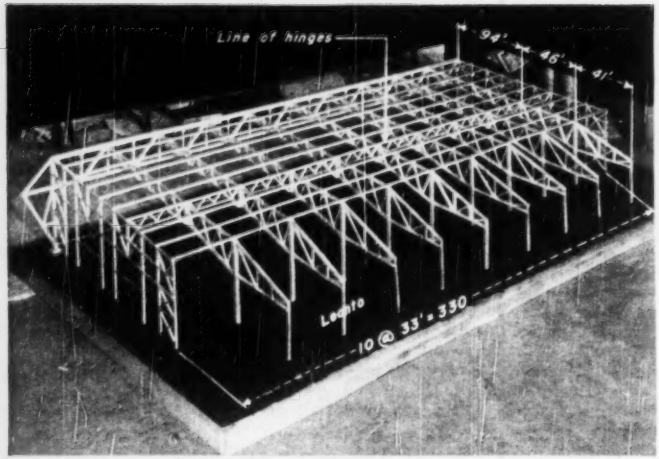
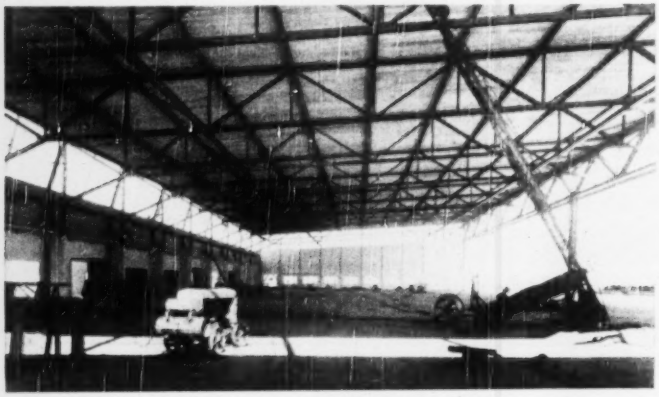


Fig. 2. EXPECTED PERFORMANCE CURVES for a pump-turbine unit when pumping (above) and when generating power (below) at a plant where the head ranges from 60 to 90 ft.

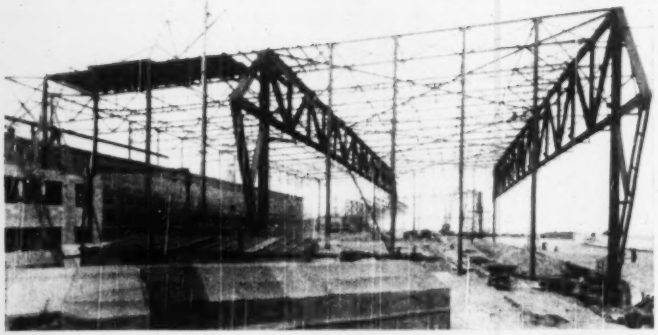
Three



CANTILEVER CONSTRUCTION was used for Traffic Hangar No. 1 at Copenhagen airport to lighten load on the 330-ft truss at the front.



NO COLUMNS obstruct the 165x400-ft interior of Traffic Hangar No. 2, but one column splits doorway. Knee braces at leanto (left) were erected after roof.



TWO RIGID FRAMES of 250-ft span support the trusses of the repair hangar. Members are built mainly of rolled sections and are welded.

THREE all-welded steel hangars—one a unique cantilevered structure—have been completed as part of a major expansion of the airport at Copenhagen, Denmark. Erection methods, as well as the design of the hangars, indicate the emphasis placed by the engineers on conservation of steel, to keep costs down.

The current work includes new runway construction and provision of shops, hangars, and other facilities for transient and Copenhagen-based aircraft. Each hangar has a leanto at the rear for house storerooms and work shops.

• **Long Spans**—Probably the most interesting structure is Traffic Hangar No. 1, 140x330 ft in plan, with a clear door opening of 330 ft—the full width of the structure.

The roof framing consists principally of 140-ft long trusses, spaced 33 ft on centers. They span from the back of the hangar to a 330-ft long truss at the front. They support purlins at 15-ft intervals and lightweight precast concrete roof slabs.

In view of the high cost of steel in Denmark, the engineers were mainly concerned with the 330-ft truss, which accounted for a great percentage of the tonnage in the building. Also, on account of the clearance for the sliding doors, only small deflections due to live load could be tolerated.

• **Special cantilever design**—The engineers, therefore, decided to decrease the load on the big truss as much as possible. Dividing the 140-ft trusses into two sections, they called for a cantilever section spanning 46 ft from the leanto, which serves as a counterweight. At the ends of the cantilevers, they provided a hinge connection to support a 94-ft simple span section, the other end of which is carried on the 330-ft truss.

Thus, a substantial reduction of load on the main truss was obtained, since it need carry only half the load from the hinges to the front of the hangar, that is, the load on 47 ft instead of that on the 70-ft half-depth of the hangar.

The main truss is the horizontal member of a two-hinged tied rigid frame. Two 12x8-in. steel tension bars cast into the concrete floor of the hangar take the horizontal reaction.

During erection, the bars were welded to one column. Until the roof

Welded Hangars Designed for Economy

was in place and members carried full dead load, the columns were prevented from moving by four 100-ton jacks acting between the second column and the tension bars. Finally, the bars were welded to the second column. This reduced the deflection at the center of the truss. It also gave a more favorable distribution of bending moments than if the tension bars had been welded to the columns before dead load was applied. In that case the bars would have stretched enough, according to calculations, to permit the columns to move 2¼ in. apart.

• **Wind bracing**—The end-wall columns are rolled sections. Between these, a 5-in. reinforced concrete wall was poured, faced on the outside with precast slabs of lightweight concrete. Bracing for wind pressure on this wall consists of a horizontal truss in the two outer bays of the roof, transferring pressure to the back wall and the main truss.

Wind pressure on the doors and front truss is primarily taken by horizontal bracing between the truss and the first purlin. The pressure is then carried through the 140-ft trusses to the roof of the lean-to, which acts as a horizontal, reinforced concrete girder. This girder transfers the wind load to the ground through vertical concrete walls.

• **Types of steel members**—The steel used corresponded to the British standard specification, with a yield point of 40,000 psi. The allowable working stress for dead load plus snow, or dead load plus wind, was 20,000 psi and for dead load plus snow and wind 25,000 psi.

In general, the hangars were built with rolled sections, reinforced where necessary with plates. The stresses in the front truss of Traffic Hangar No. 1, however, were too big to enable rolled sections to be used. Instead, plates were welded together to form U-shaped sections for top and bottom chords and H sections for the web members. The depth and width of the top and bottom chords are constant. The height of the H sections is equal to the distance between the web plates of the chords, thus simplifying connections (see drawing). By varying the thicknesses of the plates from which the sections are built, the engineer obtained sectional areas that kept stresses close to permissible values.

The total amount of steel used for the hangar is about 450 tons, or roughly 18 psf.

The precast roof slabs were made with expanded clay aggregate. They are 52 in. thick, 20 in. wide and 15 ft long. The bottom side is corrugated, to reduce the amount of concrete in the slab, and the reinforcing bars are in the deepest portions to take advantage of the corrugations.

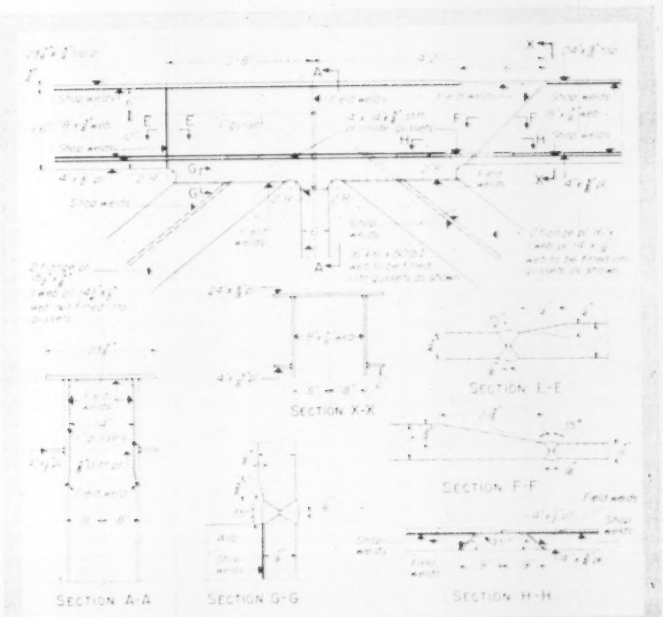
• **Trusses assembled on site**—The structures were assembled almost exclusively by welding. In cases where the sections were built up of plates, ¼-in. continuous fillet welds were usually employed for assembly. These welds were all made in the shop, but the truss members were assembled on the site. All important welded connections were X-rayed as a safety inspection.

Most of the gussets in the main truss have rounded re-entrant corners to avoid a notch effect. Field splices in the main girder were made near the points of counterflexure with turned bolts.

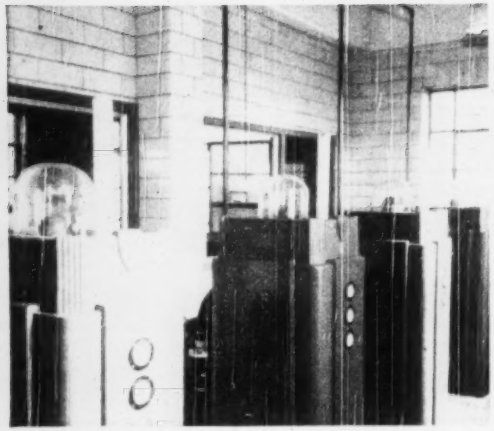
• **Features of other hangars**—The two other hangars, one of which is 140x250 ft and the other 165x400 ft, are built on more conventional lines. The larger hangar has a steel column in the center of the 400-ft opening to support the truss above, and the smaller hangar has two 250-ft rigid frames about 70 ft apart to carry the trusses.

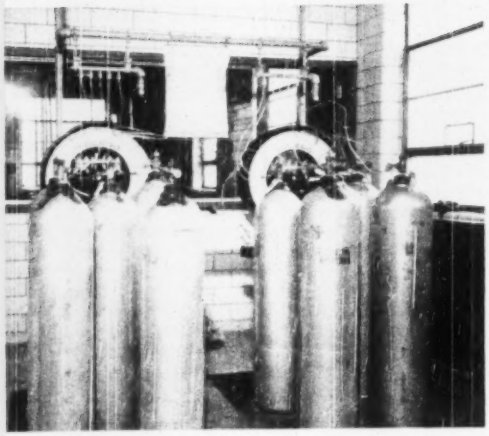
Indicative of the thought given to conserving steel, knee braces between the 165-ft trusses and the columns at the lean-to in the big hangar were not installed until the full dead load of the roof was being carried by the trusses. This decreased the bending stresses in the columns.

V. Lauritzen was architect and O. Brodsgaard consulting engineer, both having offices in Copenhagen. Universal Steel Door & Engineering Co., Ltd., of West Bromwich, England, was contractor.



ASSEMBLY of the truss at the front of Traffic Hangar No. 1 was done with field welding. Built-up members were shop welded.





FOUR FULLY AUTOMATIC CHLORINATORS drawing from two sets of five cylinders each (right) feed the chemical proportionately to the flow

Automatic Chlorination Safeguards Outflow from an Open Reservoir

PHILADELPHIA has taken another important step in improving quality of water delivered to its citizens. A fully automatic chlorination station—which safeguards outflow from the uncovered East Park Reservoir—is now in routine operation.

This $150,000 station, hosts Elbert J. Taylor, chief of the water bureau, puts the required dosage of chlorine into water drawn from the reservoir—even though outflow varies widely. This dosage in proportion to flow insures that pollution, which may be picked up in the open basin, is made harmless before water is consumed.

Piping for the disinfecting installation is arranged to maintain circulation in the storage basin to advantage not possible with the original flow scheme.

In the past, the only protection of sanitary quality has been manually operated chlorinators without coordination to flow rates and without circulation in the reservoir. The reservoir was, of course, fenced in and a watchman stood guard at the outlet works.

• **Simple systems**—The chlorination station, sometimes Taylor contends, is basically simple.

1. Piping to route treated water from two plants into and out of the reservoir (see box and plan).

2. Venturi meters and cone valves located on the main and bypass lines.

3. Automatic control equipment for proportioning chlorine dosage to pressure differentials (flow rate) in the outgoing lines.

4. Chlorinators and chlorine-handling and storage facilities.

Five parallel pipes pass through the chlorine house. Each has a Venturi meter and a cone valve just downstream from the throat pressure rings.

Two 54-in. pipes (2 and 3) convey flow in and out of the reservoir. Each has a 24-in. bypass (1 and 4). Venturis and cone valves on 1 and 2 are set to allow flow into the reservoir; those on 3 and 4 to permit outflow. Bypasses are utilized for flows up to 15 mgd. The larger mains, says Taylor, are brought into play by electrical contacts in bypasses when this flow is exceeded. The contacts activate closure of the smaller valves and opening of the larger. When flow decreases to 15 mgd, flow is shutted back by the same controls.

Pipe 2 outflow is connected to four lines leading into the southeast basin of the reservoir; pipe 3 outflow to four lines from the northeast basin. Circulation in the reservoir is, therefore, into the southeast, through the west and into the northeast basin. Leaving this basin, the water flows through the chlorine house and into the distribution system.

Pipe 5 handles supply from the Queens Lane filter plant. Its Venturi tube records flow and its cone valve, with automatic controls, feeds the system according to pressure requirements. Gravity flow is controlled by an automatic hydraulically operated 5-in. cone valve to prevent complete drainage of the QL clear well.

Pressure controls in this line are set to maintain a pressure gradient on the downstream side of the valve at night

THE EAST PARK RESERVOIR

The East Park Reservoir — Philadelphia's largest open distributing reservoir — "floats on the line" to maintain balanced pressure in the distribution system. It serves about one-fourth of the city's population.

Divided into three sections, the mammouth basin holds 688 mg, and spreads over 100 acres. It's formed by 40 ft high earth embankments. Water slopes are faced with brick and mortar. Water depth is 25 ft. Sections are connected by 30-in. valved pipes.

Four 36-in individually valved pipes enter both southeast and northeast basin under a common gate house. Traveling screens protect these pipes at points of entrance to the reservoir.

Treated water from the Queens Lane filter plant (83 ft above the reservoir) and the Torresdale plant via the Lardners Point pumping station—is delivered to the EP reservoir (see plan).

INDICATING, RECORDING and totalizing gages report flow continuously through Venturi meters (right). Cone valves in Venturi throats are hydraulically operated.

of 10 to 15 ft above the reservoir level. Thus, Taylor observes, permits the reservoir to fill. During the day—with the pressure gradient about the same amount below reservoir levels—water flows into the distribution net.

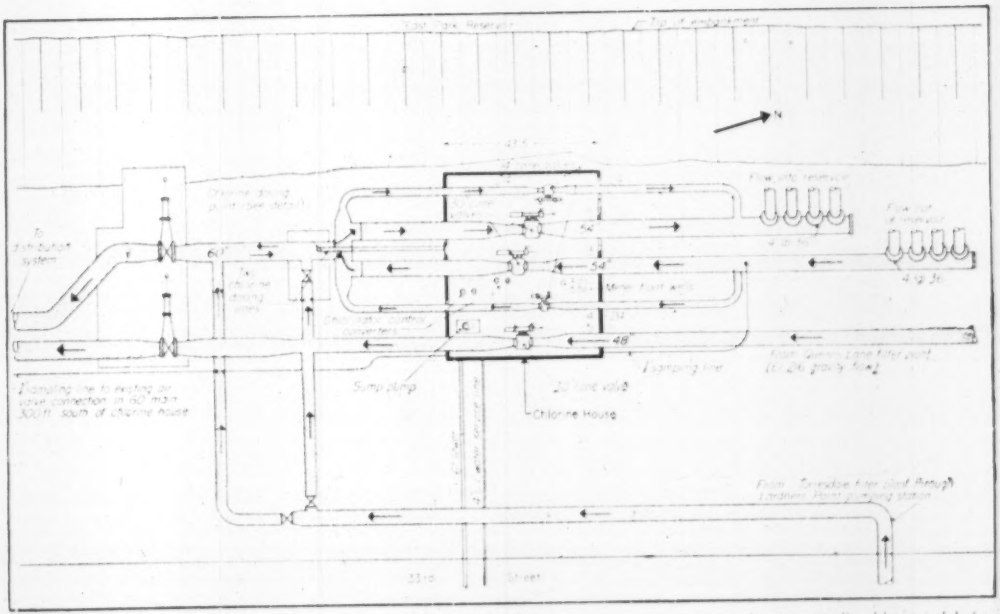
Inflow and outflow to balance drafts is governed by the setting of different pressures for day and night. An electric timer actuates solenoid valves to shift control from one hydraulically operated poppet valve to another at desired hours. Each poppet valve is set to maintain a predetermined pressure in the system.

Another supply main from the Forestdale plant is outside the chlorine house. Connected to pipes 2 and 5 and the distribution system, it is valved either to bypass or feed directly into the reservoir.

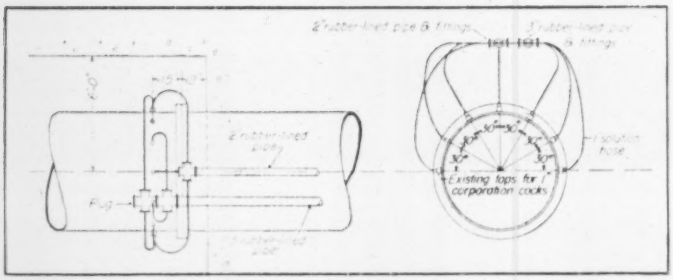
Cone valves—actuated automatically by a hydraulic system only—have hand wheels for manual operation. Working pressure for the system is 70 to 100 psi. Oil and air storage tanks, 5-hp oil pumps and 2-cfm compressors are in duplicate.

• **Chlorine feed**—Pressure differentials (flow rate) across all Venturi meters is transmitted by small pipes to chlorine-control converters. The converters, Taylor points out, actuate chlorinators to proportion dosage directly to flow.

Of the four chlorinators, only two



FLOW FROM TWO FILTER PLANTS is routed through East Park Reservoir's three basins and automatically chlorinated before it enters the distribution system.



CHLORINE IS INJECTED to the 60-in. main through seven 1-in. corporation cocks.

will be utilized normally. Once with a 400-lb feed scale, serves the large outflow main; another, with a 100-lb scale, serves its bypass. The standby machines provide double capacity if chlorine demand becomes excessive. Each chlorinator has a wall switch to change over from manual to automatic control.

Chlorinators are actuated by 50 psi water pressure. It is supplied individually from ten 50-gpm, 5-hp, 150-ft head centrifugal pumps drawing from pipe 5. Pump discharges, however, are interconnected for flexibility. Water pressure is also available from the street main for emergency operation.

Chlorine is supplied from ten 150-lb cylinders. Two cylinders each on two 1-month flush scales are connected to a discharge header with a pressure reducing valve that reduces it to a usable 30 psi. One group is set for delivery at 40 lb, the other at 50. With the four chlorinators connected to these headers, the latter group will not deliver chlorine until the former is empty. When cylinders are replaced on the scales, setting of the reducing valves is reversed by the operator.

Chlorine solution is injected into a 6-in. distribution main connected to pipes 1, 2, 3, 4 and 5 through seven corporation cocks with one inch diameter test sockets. Cocks are set in holes drilled below the 60-in. outlet and suction pipes, two from each of the other 5 pipelines. The test is passed underground to the point of dosing through a 1-in. CI pipe, the second in the set.

• **Flow gaging.** Pulsating, recording and totalizing gages are on each Venturi meter. Pressure differentials across the Venturis are piped to meters that gate the flow connected to the gages. Capacities and Venturi sizes are: Inflow and outflow pipes 2 and 3, 50 mgd, 24 to 50 in.; bypass 1 and 4, 15 mgd, 24 to 44 in.; and supply main 5, 70 mgd, 48 by 30 in. These meters give flow into the reservoir, part of it and from the OL plant by gravity. Taylor states:

Wall-mounted circular-pen recorders also give pressures upstream and downstream of cone valves in the reservoir inlet and outlet pipes as well as at the OL line. A single pen gage records oil pressure in the hydraulic system.

• **The chlorine house.** The brick and concrete station has three floors. In the 18-ft deep basement are the Venturis, cone valves, converters and float pots.

A balcony comprising one-third of building area rises up the basement floor. On it are located the oil pressure system equipment, compressors, water pumps and a copper sulphate feeding system. The CS system includes a solution tank and two feed pumps. The pumps are equipped with automatic proportioning devices to add copper sulphate entering the reservoir. The system will be utilized for controlling growth of microscopic organisms during the summer.

The main floor at ground level is paved to a center opening through which access is had to the 12-in. meter in the reinforcement. Above the well is a monorail and hoist for servicing.

The office, locker and control, locker and heater rooms are on the north side of the main floor. Steel lockers and washing and toilet facilities are included in the locker room. A coal heater with blower to force warm air to lower levels, a workbench and slop sink are in the heater room.

The chlorine and scale rooms are on the south side of the main floor. Also the office and meter and control room over the north side. Here there is a sink in an S.S. laboratory bench and three sampling spigots. Water flows continuously from the OL supply line, from the 3 service discharges and from the outlet mains after chlorination. Samples are taken and chlorine residual tests are made at three hour intervals.

• **Operating failures.** Pressure switches in water lines to chlorinator ejectors must be satisfied, be indicated, whenever the circuit is energized for operation of a particular unit. If pressure is inadequate for proper functioning an alarm is sounded.

When the electric current to valve controls fails, the smaller valves will operate by their diaphragm controls to allow diminished inflow and outflow up to their capacity. The larger outflow valve must be opened manually during emergencies. All outflow would, of course, be chlorinated automatically.

Electric failures are indicated by the cutting off of signal lights on the main control panel and by the smaller meter moving to its limit without change over to the larger one.

With failure of pumped water pressure, chlorinators are operated from the street main.

• **Credits.** The chlorine station was designed by the water bureau's engineers. Consulting Engineer was Marcus Knowles, Inc., Pittsburgh. The project was built under six contracts. Large mains, valves and substructures—Kaufgum Construction Co.; chlorine house—Wintz Bros.; plumbing—W. M. Anderson; heating—E. E. Roberts; electrical—W. V. Pangborne; and chlorinators and accessories—Wallace and Tiernan Co., Inc.

Milwaukee Saves Money On Water Bills

By eliminating a good deal of unnecessary work, using its meter readers more efficiently, and substituting mail delivery for meter reader delivery, the city of Milwaukee, Wis., has made substantial savings in overhead for its waterworks department.

According to T. E. Tanghe, superintendent of the waterworks, the new system saves the city about $50,000 a year in its meter reading department.

The system is:

Bill delivery by postal card, special investigation of complaints instead of regular meter readers, leaving of a self-addressed bill card on the first visit to a place where the resident is not at home, reading meters on a quarterly basis rather than on a monthly basis.

Other changes include an incentive system to recognize the daily number of assignments covered (this is under consideration now), recounting of the meter readers' course to produce more routing with less effort.

Studies leading to the introduction of the new efficiency system were made under direction of Robert C. Garmer, classification examiner, and George C. Sifton, budget supervisor.

Better Asphalt Pavements Produced By Proper Handling of Plant Mixes

N. M. Finkbiner
Engineer of Materials
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Salem, Ore.

THE TITLE of this article might lead one to believe that nothing that follows will shed any light on the problems facing localities dealing principally with "road mixes" or "mixed-in-place" asphaltic pavements. This is not the case. Characteristics desired when aggregate and asphaltic cement are blended do not depend on the **method** of mixing, but upon the theoretical and practical blending of the correct components in the correct quantities.

For many years, paving technicians and others interested in bituminous mixes strove to obtain a mix with the least amount of voids—hence the maximum density. Maximum density had to be obtained with due regard to economy. I believe it can be demonstrated that a "gap-graded" mix will achieve a higher density than one not so graded when the materials are produced by normal screening operations, which generally contain over and under run of the sizes.

With a material graded 1 in.—¾ in., ¾ in.—½ in., ½ in.—¼ in., ¼ in.—No. 10, No. 10—No. 200, gap-grading would omit every alternate size. Thus coarse material would be used 1 in.—¾ in., ½ in.—¼ in. and No. 10—No. 200. A mix one of the correct proportions of the last three would give a denser mix than a mixture of all the sizes enumerated. The majority of spaces between particles of the ¾ in.—¼ in. grading are too small to contain the ½ in.—¼ in. size without spreading the 1 in.—¾ in. stones apart; the majority of the ½—¼ in. particles would fit into interstices of the former size without forcing the stones apart. Of course, it is not economically feasible to discard the ¾—½ in. and the ¼ in.—No. 10 sized particles on account of the expense involved. The ideal of perfection must often give way to adequacy.

• Voidless paving dangerous?—The belief—based on a wealth of tests and practical experience—is spreading that a voidless pavement obtained immediately after laying is dangerous. Some very progressive technicians now want 3 to 5 percent or even slightly higher voids in the newly finished pavement.

There is evidence to prove that pavement voids of about 5 percent should be there to be removed by the traffic in the first three summers. If such voids are not present, traffic will work in excess of asphaltic cement to the surface, and although durability and dynamic stability may be maintained, the pavement will have to be surface-treated to obtain non-skid characteristics. Compaction by traffic in warm weather is greater than compaction by a ten-ton "three-legged" roller.

Further consideration of coarse non-skid mixes shows that these so-called, open mixes, do not stand up well under severe ice conditions. There are two reasons: (1) Due to open texture, water can penetrate slightly below the surface and loosen some of the larger stones when it freezes. (2) chains on the wheels of motor vehicles often catch on the edges of the stones and loosen them.

But non-skid mixes composed of material all passing the 2-in. screen if suitable in other ways, will successfully withstand the alternate cycles of freezing and thawing and the excess wear due to tire chains, probably because water cannot readily penetrate and freeze, and the particles are so small that any given section of chain bears on several particles at the same time.

There are two further considerations that must be correlated to types of aggregate mixes dealt with above: Thickness of asphaltic film and percent of asphalt. **In any given mix** there be ir a close relationship because the thicker the films the higher the percent of asphalt until all the voids are filled, and any excess asphalt will be worked to the surface. If there is more than enough binding medium to fill all the voids in the compacted mass, the excess appears on the surface.

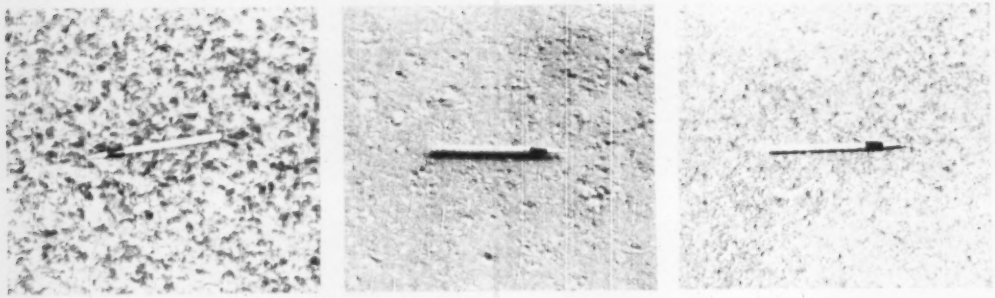
• Durability depends on asphalt—The durability of any bituminous mixture—provided it has sufficient strength within itself, within its base and its subgrade to carry the traffic—depends on the amount of asphalt contained therein. In other words, the thicker the films of asphalt surrounding each particle in the mix, the longer the time required for the moisture and oxygen in the air plus the ultra-violet light from the sun to oxidize the asphalt. On the other hand very thin films are much more readily acted upon by the above agencies, and the hardening effect in the mixer is more pronounced.

Starting with a given maximum size coarse aggregate, the denser the mix, the greater is the total surface area in a unit volume and the smaller the percentage of voids. The total amount of asphaltic cement in a dense mix may be more than in a less dense one, but the film thickness is also less, due to increase in surface area, and the relatively smaller amount of voids.

The principal influencing factors in mixes are: (1) Effect of temperature, (2) asphalt, (3) filler, (4) aggregate and the complete mix.

• Effect of temperature—It has been proven by work done in our laboratory that a great deal of the hardening of asphaltic cement takes place in the mixer (Proceedings, Highway Research Board, 1947, p 197). Asphaltic cement at high temperatures and thin films oxidizes more rapidly than at lower temperatures and thick films. Therefore, since temperature of the aggregate controls temperature of the finished mix, the aggregate should never be higher than 300 deg F. The rate of hardening of the AC increases very definitely at 300 deg F when subjected to agitation in the mixer. Ideal conditions for hardening are high temperature and thin films.

• Types of asphalt—The style in asphaltic cement has changed over the past 35 years. The grade of paving asphalt in use 35 years ago was about 40-60 penetration. At about that time a trend toward higher penetration was initiated reaching its crest about 1940. Stabilization (at least on the West Coast) is now about from 85-150 penetration. This requirement of increase in penetration had to do with dynamic stability. If the danger point of an asphalt in a road is about a penetration of 20, it was believed that (everything else being equal) the AC that started at a higher penetration would take longer to harden to the



TYPES OF ASPHALT SURFACES vary with the materials used, but all can be given adequate density and non-skid characteristics by proper grading of the materials.

danger point of 20, hence insuring increased toughness of metalplex.

Attempts are now made to select an AC grade according to the climatic conditions of the locality in which it is to be used. However, there is little choice in locations in which there are 100 deg F summers and zero and below winters. It is not economically feasible to have an asphaltic cement with both a softening point and a brittle point to meet the above limits.

• **Character of the filler**—The commonly accepted definition of filler is material that will pass a 200-mesh sieve. Various specifications for filler require varying amounts to pass the 200 sieve. The Oregon requirement is that all the filler must pass a 50 sieve and at least 75 percent must pass a 200 sieve. Of the portion passing the 200 sieve, at least 75 percent shall be impalpable dust by an elutriation test.

Although the stated requirements are given in percentage by weight, what is actually required is a certain volume of filler to increase the density in the dense mixes. Since volume is desired, the specific gravity of the filler must be taken into consideration. For example, if ground limestone and hydraulic cement are considered, and if both have the same grading, 5.1 pounds of hydraulic cement will be equivalent to 2.7 pounds of ground limestone by volume since 5.1 and 2.7 are their relative specific gravities. If the percentage of voids in the same two products, their weights vary as their specific gravities for equivalent volumes.

I have seen very few asphalt plants at which there was no loss of filler. At those plants requiring a strong draught for the efficient use of fuel, very few dust collectors are capable of removing all the dust from the released gases. It is therefore better, if possible, to add the filler by weight or volume into each batch, from the mixer platform directly into the mixer.

Some engineers prefer to consider the filler only as a stiffener for the asphaltic cement. Thus, if one is using an SC-3 or an SC-4 in a plant mix, the dynamic stability would have to be obtained from the filler in the aggregate. The rapid oil itself would have little stability at ordinary temperatures. So it can be stated that the less viscous the road binder used in a mix, the greater must be the amount of filler used to obtain stability.

Consider the use of a 60-70 penetration asphaltic cement in a plant mix. Agree by definition that the mixture of filler and AC is the mortar which is to be used to coat the aggregate particles. Then I think you will find that not more than 55 percent of this mortar by weight should be filler (filler in this case being hydraulic cement with a specific gravity of 3.1). A greater percent of filler than 55 percent by weight of hydraulic cement begins to be more than the asphalt is able to assimilate without becoming crumbly.

• **Aggregate and complete mix**—Many arguments have taken place as to the merits of all crushed material versus round material in bituminous mixes. There are those who hold that mixes with round aggregates are not structural, and such aggregates should never be used. It seems to me that no flat rule can be laid down without knowing the type of mix that is contemplated.

In a penetration job there is obviously very little strength to be obtained by the interlocking of round aggregate (round aggregate can hardly be said to interlock). They would, however, present a certain amount of friction in their displacement. Most of the dynamic stability in this case would of necessity be obtained from the binder used.

But penetration macadam cannot be compared to a dense plant mix owing to the excess of fines which is used in the plant mix. Thus the interlocking of aggregates in a dense plant mix is inconsequential. Therefore, round material can and has been used in dense plant mixes to my personal knowledge, without any lack of adequate dynamic stability.

Undoubtedly, a triaxial test for stability, and perhaps other types of tests, might show more stability by the use of all crushed material in a dense mix. But it seems to me we have two kinds of stability to consider: (1) an ideal stability of the highest order, which might be obtained only by the use of 100 percent crushed material, and (2) **adequate** stability which can be obtained by 100 percent round aggregate.

• **Stability**—Adequate stability is that stability which is sufficient to carry the traffic on a road without more than ordinary evidences of use. Ideal stability is the maximum amount of stability which it is possible to incorporate in the mixture.

The term stability may be divided in another way. Let us call the type of stability as determined by a triaxial test, static stability which is the support of a dead load. This means that the vertical load as applied in the triaxial cell is static in character. It means that the layer or layers of aggregate close to the head and base of the cylinder are more or less held in their relative positions by the friction of the top and bottom plates. Maximum distortion of the specimen would be in the center.

No doubt it can be proven that a well graded aggregate tested in the triaxial cell will have more stability (static stability) than that same well-graded aggregate coated with asphaltic cement. In this type of test, the AC would act as a lubricant.

The triaxial test is probably the

most accurate for measuring the deformation of elastic mediums. The second type of stability, which the triaxial test does not determine, I call dynamic stability for want of a more descriptive word. By this term I mean that stability which will withstand all the vicissitudes of the average pavement—the changing conditions of weather and traffic.

• **Traffic effect**—Ignoring the effect of weather, let us consider the effect of traffic. There are two ways a pavement may fail under traffic, due alone to the dynamic instability of the mix. Through shoving or rutting, or by disintegration of the surface. Rutting which is the direct result of the disintegration of the surface in a wheel track after the passage of many vehicles is not in this case considered to be rutting. It is merely the evidence of progressive disintegration. True shoving, which may cause ruts, is internal and bears no relation to disintegration. The failure of a well-graded, statically stable mixture of mineral aggregate **only**, under traffic, would come about through the non-bound condition of the surface layer or layers. As rapidly as the top layer failed by disintegration, the next layer would fail probably under the next load. Thus the failure under dynamic loading is progressive; and in a short time the unbound mix would be useless.

Disintegration bears no relation to a static stability test nor does rutting which increases progressively from the surface. The triaxial test, however, will give positive indications concerning the anticipated behavior of a mix in regard to the tendency toward internal displacement. For example, a thin layer of penetration macadam, composed of sound rock on an unyielding base, will carry heavy traffic until either the binder holding the successive top layers in place deteriorates by weather, or the stone in the top layers is progressively worn away by traffic.

As previously mentioned, fast rubber tired traffic soon demanded non-slippery surfaces. One early answer was to roll stone chips into the surfaces of dense mixed pavements immediately after the initial rolling. These chips were used either uncoated or coated with asphalt, and applied to the roadway surface at the rate of about 5 to 20 lb. per sq yd, but the method was not very successful. Now the best method is to build the non-skid character of the road into the mix (open mix).

Open mixes, so named because of the large percentage of voids contained therein, first utilized an aggregate with about one inch top size, and much thicker asphalt films. Difficulties in cold winter climates developed, due to the use of chains on the tires. It appears that the larger the maximum size of stone used, the more severe the injury. To obviate this difficulty the maximum size of the stone was reduced, and in Oregon we now use this mix:

	Percent
Passing 2 in. screen	100
Passing 2 in. and retained on No. 10	50 to 70
Passing No. 10 and retained on No. 200	20 to 36
Passing No. 200	4 to 7
Asphaltic Cement	5.5 to 7.5

This material is to be composed of all crushed particles and is used as a resurface on the water tight base at a minimum thickness of 2 in. Since the mineral aggregate in the above mix is composed almost entirely of the product of a crusher, and therefore is lacking in the sizes between the No. 40 and the No. 200 sieves, it cannot be classed as a dense mix. On the other hand, although this mix has a higher void content than a dense graded mix, it obtains water tightness from the thickness of the asphalt film surrounding the particles. It can be set so that no bleeding will occur if the base on which it is laid is not a rich bituminous base. Any surface mix is apt to bleed under traffic in warm weather, if laid on a rich asphaltic base.

Notes on Legal Decisions

Summaries of decisions relating to construction prepared by I. Vernon Werbin, counselor at law and engineer, New York, author of Legal Phases of Construction Contracts (McGraw-Hill)

Determination of Disputes

Construction contracts as a general rule provide that all disputes that may arise during the course of the work will be determined by the architect or engineer and that such determination will be binding and conclusive on all the parties to the contract.

In one New York case[1] the contract provided: "To prevent disputes and litigations, the engineer shall in all cases determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this contract, shall determine all questions in relation to the works and the construction thereof, and shall in all cases determine every question which may arise relative to the fulfillment of this contract on the part of the contractor. His determination and estimate shall be final and conclusive upon the contractor and in case any question shall arise between the parties hereto, touching this contract, such determination and estimate shall be a condition precedent to the right of the contractor to receive any money under this contract."

The court held that even these broad provisions of the contract did not make the determination of the engineer conclusive where a question of law was involved but "on the contrary, in line with our rule of public policy which invalidates agreements ousting courts of jurisdiction over controversies arising under contracts and submitting all their rights and liabilities to arbitration for final adjudication * * * we hold that the engineer's construction of a contract, if erroneous, does not bind the parties, and that notwithstanding such certificate, the court will construe the contract and afford relief where the engineer has given an erroneous construction thereto."

The court in its opinion in the same case further stated: "Although a contractor is not concluded by (bound by) an erroneous construction placed on the contract by the engineer, it is well settled that in the absence of fraud or bad faith the determination of the engineer and his certificate are final with respect to the quality of material offered for use by the contractor and with respect to the quantity and classification of material as the basis for computing the amount to which the contractor is entitled."

In another New York case[2] where the same contract provision was involved in the litigation, the court held that even if the engineer's final certificate was "a condition precedent to payment, it still may not be arbitrarily withheld. So if this action involves an erroneous construction of the contract, if it appears that there is no reasonable basis whatever for his action, if it is patently erroneous, then we find the equivalent of bad faith on his part and the contractor is not bound by his decision."

Where the contract confers upon the engineer, the arbitrator, power to determine the effect of any stipulation of the contract and whether or not there has been a performance of the same by either party, and to decide "all matters in dispute arising or growing out of the contract", and further provides not only that the decision of the engineer as arbitrator

shall be final and conclusive between the parties, but each party "waives all right of action, suit or suits or other remedy in law or otherwise under this contract or arising out of the same to enforce any claim except as the same shall have been determined by said arbitrator", the court held the clause invalid as it tended to oust the jurisdiction of the courts.

The courts of most states have adhered to the rule that the determination of a dispute by the engineer or architect where it involves a construction of the contract will not be binding or conclusive on the parties, as such contract provisions tend to oust the courts of their jurisdiction to determine questions of law.

The United States Supreme Court in a recent decision has held that the parties to a contract are competent to contract to the effect that all questions that may arise in the performance of a contract shall be referred to a designated person for determination and the determination made by such designated party is binding and conclusive on all parties even though a question of law is involved in the determination.

In that case, the specifications provided: "If the contractor considers any work demanded of him to be outside the requirements of the contract or if he considers any action or ruling of the contracting officer or of the inspectors to be unfair, the contractor shall without undue delay, upon such demand, action, or ruling, submit his protest thereto in writing to the contracting officer, stating clearly and in detail the basis of his objections. The contracting officer shall thereupon promptly investigate the complaint and furnish the contractor his decision in writing thereon. If the contractor is not satisfied with the decision of the contracting officer, he may, within thirty days, appeal in writing to the Secretary of War, whose decision or that of his duly authorized representative shall be final and binding upon the parties to the contract."

The action was brought to recover additional compensation for certain work that the contractor was ordered to perform, the contractor claiming that the work demanded to be performed in line was outside of the contract and pursuant thereto was not governed by the unit contract price. The Secretary of War denied the claim. The contractor then brought an action in the Court of Claims. That court held for the contractor and took the position that as a question of law was involved, the determination of the Secretary of War was not binding and conclusive. The Supreme Court reversed the decision of the Court of Claims holding that the clause was broad enough to make the determination of the Secretary of War conclusive as to any and all disputes that might arise out of the performance of the contract.

The court in its opinion stated: "It is true that the intention of parties to submit their contractual disputes to final determination outside of courts should be made manifest by plain language. . . . But this does not mean that hostility to such provisions can justify blindness to a plain intent of parties to adopt this method for settlement of their disputes. Nor should such an agreement be frustrated by judicial 'interpretation' of contracts. If parties competent to decide for themselves are to be deprived of the privilege of making such anticipatory provisions for settlement of disputes, this deprivation should come from the legislative branch of government."

(1) Roberts Co. v. City of New York, 196 App. Div. 868, 187 N.Y.S. 910; City of New York v. Lehrenkrauss Co., 203 N.Y. 148, 96 N.E. 376; Mississippi Lumber & Box Co. v. U.S., 244 U.S. 262, 37 S.Ct. 621; Kihlberg v. U.S., 97 U.S. 398; Wells Bros. Co. v. U.S., 254 U.S. 83, 41 S.Ct. 32; Crichton v. U.S., 257 U.S. 491, 42 S.Ct. 207.

Destruction of Work

In a recent case, the Supreme Court of Louisiana held that where the work is destroyed during the course of its construction, even if the destruction results from defective plans and specifications furnished by the owner, the contractor is liable for the cost of correcting the damage done. An exception to this rule is recognized where the owner expressly or impliedly warrants the sufficiency of the plans and specifications.

The court in its opinion states: "Williston, a well recognized authority on contracts, states and discusses this rule and its exception as follows:

"'Even though the plans upon which a contractor undertakes to construct a building are so defective as to cause the building to fall while in course of erection, he is not generally relieved from liability.

"'The propriety of these decisions depends upon the question whether the owner can be regarded as warranting the sufficiency of the plans. If the owner through his architect or engineer can be regarded as having superior expert knowledge, and on the basis of such knowledge to represent to the builder the feasibility of carrying out the plans, the owner must be held responsible for the consequences of any defects in them. In ordinary cases, perhaps, the builder may be supposed to have sufficient knowledge of what is feasible to make unintended the assumption of responsible reliance by him on the superior knowledge of another; but where the work in question involves technical engineering skill, and the plans are made by expert professional men engaged by the owner, there seems good reason for implying a warranty.

"'Though the builder may be liable if he fails, by reason of defective plans furnished him, to complete the work which he has undertaken, yet if he can and does complete it according to the plans he is not liable for subsequent inferiority, injury, or destruction of the work, due to the defective character of the plans.'"

(2) Breaker v. City of Alexandria, 11 So. (2d) 529, Supreme Court of Louisiana, Feb. 14, 1943.

Substantial Performance

"The rule in this state," the Supreme Court of Minnesota said recently, "in the case of building contracts, is that if the facts show that a contractor has substantially performed his contract, although there were minor defects in his work, he is entitled to recover the contract price, less the sum necessary to cure the defects. However, the doctrine of substantial performance does not apply when the omission or departure from the contract are intentional or so substantial as not to be capable of remedy, so that even though the owner received an allowance out of the contract price, he still would not receive what he contracted for. If the contract is entire and performance is wilfully abandoned before completion, there can be no recovery on the contract or in *quantum meruit*."

The law is well settled that one cannot recover on a contract until he has shown full compliance with the terms thereof. A party who has breached the terms of his contract is not entitled to any recovery even on the basis of the fair and reasonable value of the work performed.

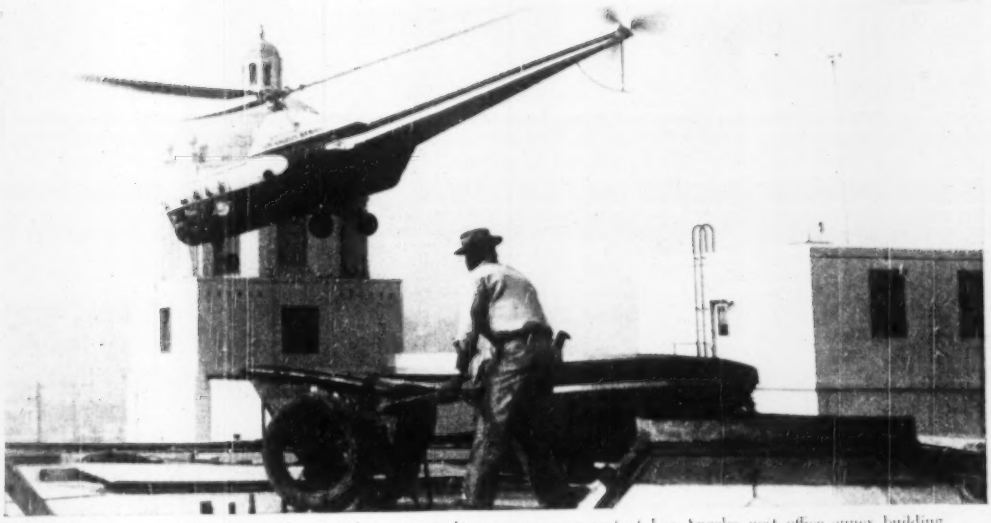
The above principles of law are applicable in most states.

(3) Haggerty v. Nash, 35 N.W. (2d) 253, Supreme Court of Minnesota, Feb. 24, 1949; Mandeville Plywood Co. v. Bond Stores, Inc., 69 F. Supp. 1, U.S. District Court, Eastern District of Louisiana, New Orleans Division, Oct. 19, 1946.

Prevention of Performance

"One who prevents or makes impossible the performance or happening of a condition precedent upon which liability by the terms of a contract is made to depend cannot avail himself of its non-performance. In other words, he who prevents a thing from being done shall never be permitted to avail himself of its non-performance which he himself has occasioned."

(4) Haggerty v. Nash, 35 N.W. (2d) 253, Supreme Court of Minnesota, Feb. 24, 1949.



DODGING a landing helicopter, workman rushes concrete buggy across new roof of Los Angeles post office annex building.

Rooftop Airport Cushions "Copter" Landings

MAIL carrying helicopters have taken to dodging wheelbarrows, construction elevators and workmen, while the Los Angeles Terminal Annex Post Office gets its roof lifted.

A fourth story is being added to the post-office structure. At the same time about half of the 500ft 160-ft roof is being built as a landing field for helicopters.

Use of the building as a heliport is not exactly new; the annex has been used for that purpose since intracity air-mail shuttle service was approved by the Post Office Department in 1947. However, the new roof is designed specifically as a heliport, and will be sound-absorbing, heavily reinforced and shock-absorbing. It incorporates several new ideas designed to insure quiet and shockless work areas immediately below the landing deck.

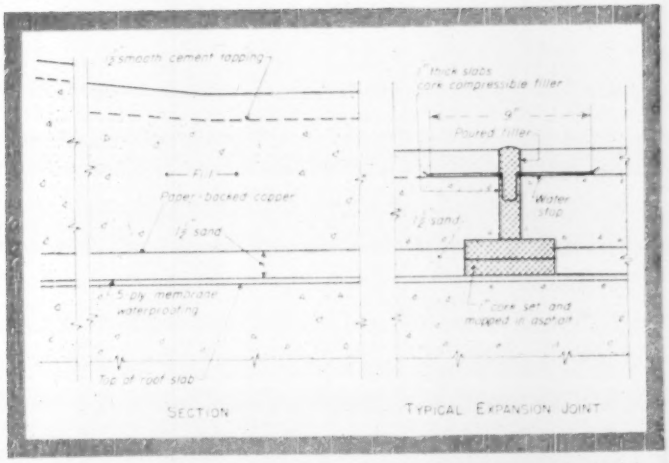
• **Insulation used**—Atop the structural steel framework that rises from the third floor is laid sound-absorbing insulation board. Made of compressed wood fibers bonded with portland cement, the 1½-in. thick board is a base for a heavily reinforced bottom slab of concrete varying from 8½ to 9 in. in thickness. Immediately on top of this supporting slab is a five-ply asphalt waterproof membrane, and atop the membrane 1½ in. of fine beach sand is packed to act as a shock and sound absorber. The sand is covered with paper-backed copper sheeting. On top of this sheeting is poured a concrete fill—a light-weight concrete of not more than 46 lb. per cu. ft. with a minimum crushing strength of 200 psi. Over this is poured a 1½-in. layer of smooth concrete topping, which has a minimum compressive strength of 2,500 psi at 28 days. Expansion joints are 40 ft. on centers.

The landing target is located at the highest elevation of the landing deck, which is divided into eight drainage areas. The drainage slope is ¼ in. per ft. Pipe railings surround the landing area.

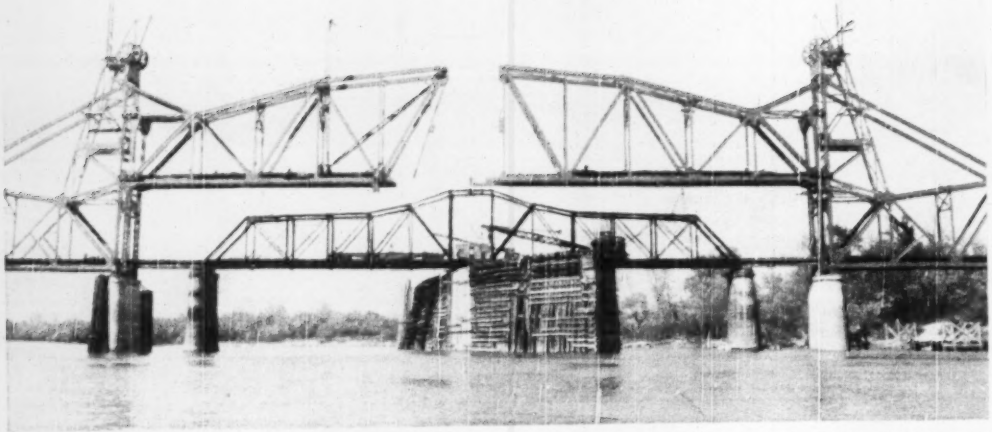
All roof installations, including landing lights, mooring rings and drains, are set flush with the landing area surface. Obstruction lights, which ring the port, are controlled by photo-electric cells that switch them on when light intensity level decreases to 35 ft. candles and turns them off again when the light level rises to 58 ft. candles.

The heliport was designed by the Public Buildings Service of the General Service Administration.

Paul L. Wicklund is construction engineer and Zoss Construction Co. of Los Angeles is general contractor.



DETAILS of the new roof show how sand blanket is utilized to provide shock-free, noise-free ceiling for offices beneath landing roof.



ERECTION of new lift span for the Southern Railway crossing of Tombigbee River (Ala.) was completed with old swing span still in place (and open to traffic) directly below it.

New Lift Bridge Erected over Old Swing Span

How long should trains have to wait while the swing span of a railroad bridge is completely replaced with a new 355-ft span?

On its crossing of the Tombigbee River on the Mobile-Selma (Ala.) line, the Southern Railway had to discontinue traffic for less than two full days while Virginia Bridge Co. performed such a switch.

Less than two days was actually only the time needed to remove the old 250-ft swing span. The new span had already been finished in lift position and was all ready to lower into place. On either side of the movable center span, fixed truss spans 275 ft long had been built with no interference to traffic in place of the 254-ft flanking trusses of the original bridge. When the time came to demolish the old swing span, the new bridge was entirely finished.

At 5 a.m. last Feb. 7 dismantling began; by shortly after noon on Feb. 8 both the river and its new bridge were ready for traffic.

E. C. Jacob
Manager of Erection
Virginia Bridge Co., Roanoke, Va.

• **Back to the beginning.** Actually, work preceding that final operation had lasted months before when locomotive cranes had put in falsework bents under panel points of the old fixed trusses. These temporary bents had carried the roadway while the old flanking trusses were removed.

New piers had to be built for the heavier new bridge. The old crossing was designed for E-27 loading; the new spans will carry E-65 loads). Since the new center span is longer than the old, new piers were built for it outside the old ones.

But pier position at the ends of the bridge did not change. This meant the roadway had to be supported on temporary bents either side of the pier positions, to leave work space for removing the old piers and constructing new ones. Steel bents on timber piles were built on the river side of the end piers, under panel points L1 of the new approach trusses that were to be built. Timber bents about 40 ft back from the end piers carried the load on the landward side.

Temporary beams spanned the gaps until the new piers were finished and the new trusses were in place. Then the new floor system went in—and all this load-juggling was done with no interruption of traffic.

• **Tower erection.** New approach trusses were completely erected, including the lower section of the lift towers. The locomotive crane then erected a stiffleg derrick on the north tower of the first tower column splice. The derrick erected the second section of tower and was jumped up to the second column splice.

Next, the locomotive crane erected a temporary bent to support the lift span at its end. And, together with the derrick, it placed the tie backing the first two panels of the lift span.

A BRIEF HISTORY

For many years traffic of the Southern Railway between Mobile and Selma, Ala., was limited by the bridge over the Tombigbee River. This 1888-vintage structure simply would not carry an increased volume of traffic.

However, the railway found insufficient justification in this limitation for rebuilding the structure until passage of the Truman-Hobbs Act in 1940. This law provides in effect that when navigation interests require replacement of structures, the federal government will pay the renewal or alteration costs required, the owner of the structure must pay only the expense of improving or strengthening the altered structure for his own benefit.

There was a navigation need. During high water season the 105-ft wide channel between piers of the old bridge was difficult to navigate. So a contract was let under provisions of the above-mentioned act. The new lift span will provide 300 ft channel width and, rising 45 ft, will have a 52 ft vertical clearance above ordinary high water.

DISMANTLING of swing span wasn't started until new bridge was finished. Then traffic was halted; the old structure was hung from the new and burned apart for piecemeal removal.

and the guy derrick that was to continue erection of the span as it cantilevered out from the tower.

Moving to the south tower, the locomotive crane and the stiffleg derrick followed the same procedure until two guy derricks were working toward each other, erecting the truss from each end toward closure at its middle.

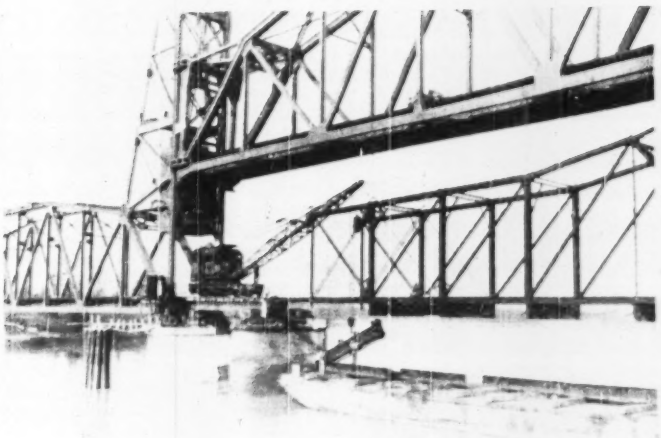
Meanwhile, small stiffleg derricks atop the towers erected sheaves, bearings, counterweights, cables, and boxes. (When the lift span was completed, these small derricks assisted in removal of tiebacks before being removed themselves).

• **Final connections**—All truss members and most of the floor system were in place in the lift span before its closing connections were made. To complete closure, thrust arrangements were installed including 500-ton jacks at each end of the lower chord and at upper ends of the tiebacks. A sufficient number of shims was placed at each pick to provide calculated gaps of 1¼ in. at the last lower chord connections and 1½ in. in the upper chords—at normal temperatures.

A slight adjustment was necessary in the bottom chord shims to connect the bottom laterals, but when all truss members were in place the actual gaps at the joints were very close to those calculated.

Calculations indicated that once bottom chord connections were made, removal of ¾ in. of shims in the tiebacks would permit the top chord connections. The calculations were proved correct.

To avoid stresses due to wide temperature change, all final truss connections were made (and erection completed) in one day. Work was started at daybreak, and the whole operation was completed in 12 hours.



SWING SPAN PARTS were lowered to waiting barge by locomotive crane. What the crane couldn't reach was lowered by hoisting engines on top of the fixed spans.

• **Swing span removal**—When the entire new bridge was finished and ready for operation, the rail and river traffic was stopped for removal of the old swing span. The lift span was cabled to its towers to prevent its lowering, and the swing span was suspended from it on lines fitted with turnbuckles. Barges were floated into place to receive members of the swing span as it was burned apart.

Locomotive cranes at each end lowered as much of the swing span as they could reach; the rest was handled by two hoisting engines placed on top of the fixed spans.

Removal of the old piers and fender piles, installation of dolphins marking the new piers will complete the work. The bridge was formally opened to traffic on Feb. 15 of this year.

Harrington and Cortelyou of Kansas City, Mo., designed the superstructure of the new bridge. Structure design was by railway forces. Hardaway Contracting Co., of Columbus, Ga., built the two main piers; Ingalls Construction Co., Mobile, Ala., put in the end piers and is taking out old piers and fender. Virginia Bridge Co. did all superstructure work—fabrication, erection and dismantling.

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New 3 Color Bulletin on Deming Deep Well Turbine Pumps

Up-to-date information on Deming Deep Well Turbine Pumps is contained in this new BULLETIN 4700.

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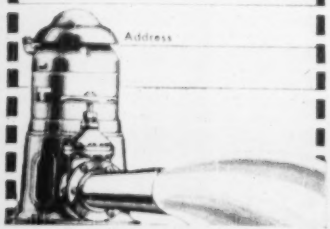


READER COMMENT

Floods at Winnipeg

Sir: We in Canada are always pleased to read of Canadian engineering activities in Engineering News-Record. Your reports on the recent Red River flood have been exceedingly well written. I should, however, like to point out a slight correction to the information contained in your June 1 issue, p. 104.

The provincial flood control proposal announced by Premier D. L. Campbell for immediate investigation is really much broader than your report would indicate. Briefly, it comprises:

(a) Red River floodway from above St. Norbert to Lockport, passing east of Greater Winnipeg.

(b) Diversion channel from Assiniboine River to Lake Manitoba, plus headwater storage, if justified.

(c) Diking and channel improvements on the Red River above St. Norbert in cooperation with United States authorities.

J. R. Rutan
Projects Engineer
Manitoba Department of Mines and Natural Resources, Winnipeg, Man.

Prestress Design Code Needed

Sir: The bulletin of the Portland Cement Association RC-25 and your editorial, "Safety Factors for Prestressing?" (ENR April 13), which comments on it, are commendable presentations of basic concepts of prestressed concrete design. Much can be learned from them. In particular, they point to a need for a code of practice for prestressed concrete.

While it is evident that it is too early to freeze prestressing techniques by rigid regulation, it is not at all too early to start discussions of the items involved. These should cover not only the safety of prestressed concrete structures, but also in comparison that of other types of construction, as so clearly outlined by Mr. Raymond Archibald in last paragraph of letter, ENR June 8, p. 831. Attention should be concentrated on bridges, especially for spans between 50 and 250 ft. This is the range in which the prestressed concrete bridge shows the greatest potentialities for economy of construction not only in Europe, but in this country as well, as shown by numerous estimates based on our methods and cost relationships.

Since prestressed spans can be assembled practically at will from standardized precast units, stringing together with highly tensioned wires and cables, the anticipated saving with prestressing should be very considerable where volume permits American mass-production methods.

While prestressed concrete bridges abroad have become an ordinary method of construction, the only prestressed concrete bridge built in the U.S. so far is the Walnut Lane Bridge in Philadelphia. There, the question of safety was solved by testing a full-size bridge beam, 160 ft long, to destruction. This test came out remarkably well and put everybody's mind at ease. However, this procedure cannot be repeated for every design because of the cost. Some guidance as to safety factors is needed by highway departments and consulting engineers.

I would like to suggest that the Bridge Committee of the AASHO, of which Mr. Archibald is chairman, appoint a subcommittee with members representing the different types of construction—structural steel, timber, reinforced concrete and prestressed concrete—to debate the question of safety factors. It is of utmost importance that fair proof loads be established for these types of construction.

Application of allowable stresses is no point at the yardstick for structural steel or timber than it is for reinforced concrete or prestressed concrete. What matters is what multiple of the live load can be placed on a structure before it suffers damaging deformation.

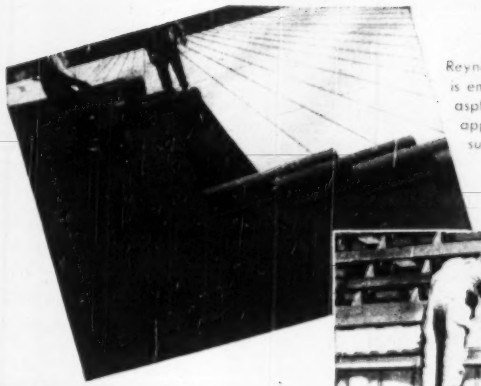
Establishment of a code of practice not for prestressed bridges and later for all types of prestressed structures will take time and should be started at the earliest possible moment. The German Committee for Reinforced Concrete began in 1943 with a draft of a code of practice for prestressed concrete. They have modified the draft every year since and have just submitted a seventh draft for discussion. While we should not require all that time, a year or two will surely pass before we can clarify the issues and thereby help the construction industry avail itself of the benefits of prestressed concrete structures.

T. Cooper
Consulting Engineer
New York, N. Y.

Correction

Though a typographical error, the name of the author of the article "Charts Give Loads Against Returning Wife" (ENR April 27, p. 592) was omitted.

The author and developer of the charts is Tyler G. Hicks, of Charlottesville Rd., Summit, N. Y. Former



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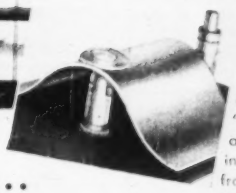

With Industrial Corrugated, Reynolds can supply Nelson "Rivweld" Studs for amazingly low-cost installation direct from above.

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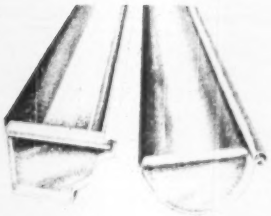

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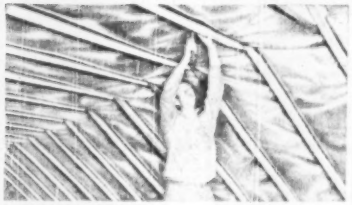

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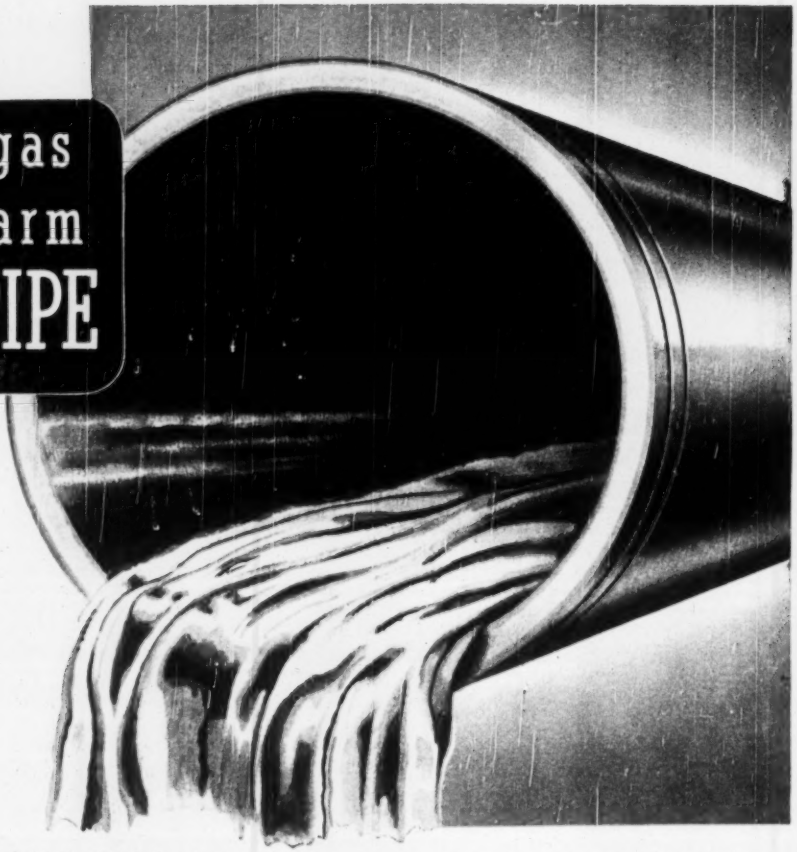

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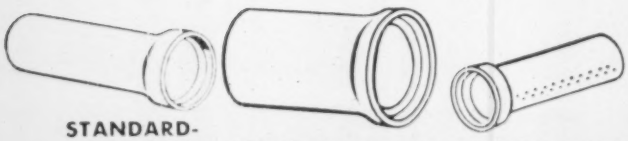

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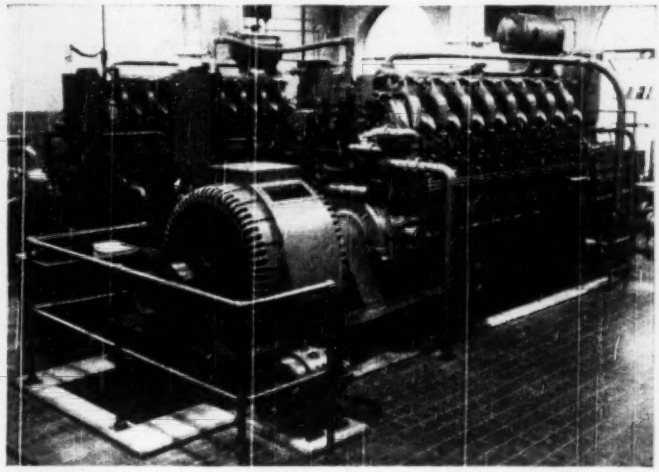

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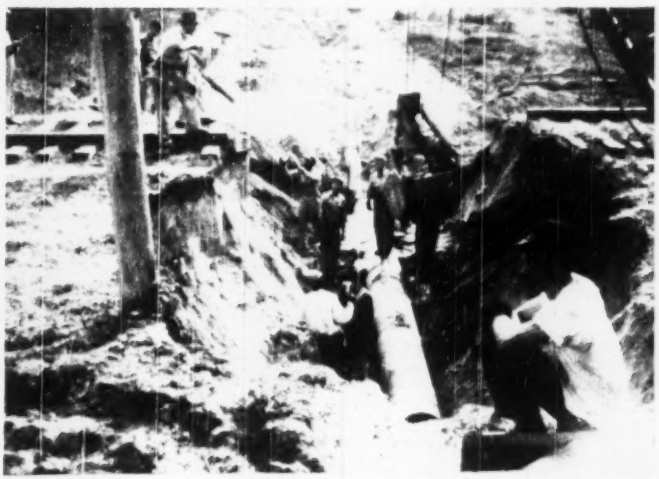

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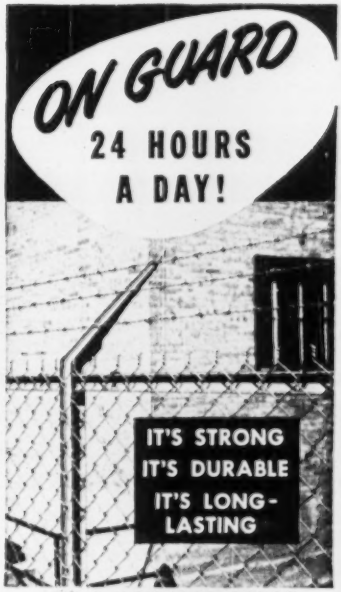

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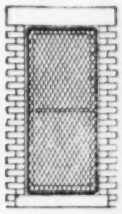

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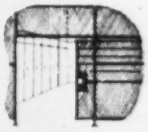

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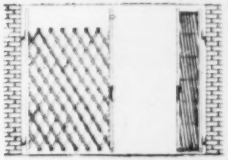

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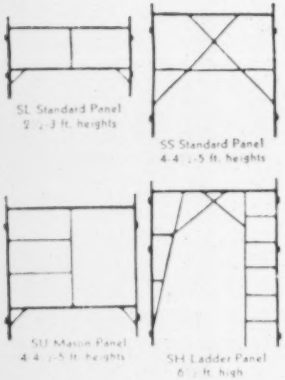

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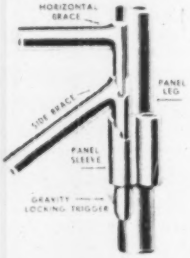

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CARE AND REPAIR OF THE HOUSE—By Vincent B. Phelan. NBS Circular 489, 203 pp. Superintendent of Documents, Washington 25, D. C. 50c.

WHAT INDUSTRY EXPECTS OF THE ENGINEER—By Charles Edward Wilson, Rensselaer Polytechnic Institute, Troy, N. Y.

ARTERIAL HIGHWAYS IN URBAN AREAS—A Preliminary Discussion, Part I—February 1950, 137 pp. Bureau of Public Roads, Washington 25, D. C. (Limited edition).

HIGHWAY CAPACITY MANUAL—147 pp. Superintendent of Documents, Washington 25, D. C. 65c.

COOPERATIVE HOUSING—A Bibliography on Housing Built or Managed Cooperatively. Housing and Home Finance Agency, Washington, D. C. Free.

LIGHTWEIGHT AGGREGATE CONCRETES—Superintendent of Documents, Washington 25, D. C. 20c.

PROCEEDINGS OF THE THIRTY-FIFTH ANNUAL ROAD SCHOOL—Extension Series No. 69, Purdue University, Lafayette, Indiana.

EMPLOYMENT OUTLOOK FOR ENGINEERS—Bulletin No. 968, United States Department of Labor, Superintendent of Documents, Washington 25, D. C. 50c.

TECHNICAL LETTERING PRACTICE—By Henry Cecil Spencer and Hiram E. Grant, The Macmillan Company, New York. $1.35.

INVESTIGATION OF LOAD DISTRIBUTION BETWEEN REINFORCED CONCRETE FLOOR SLABS AND THEIR FORMWORK—By Knud E. C. Nielsen, Royal Institute of Technology, Stockholm, Sweden.

ABZUGSKRAFTE AN WEHRVERSCHLUSSEN—By Curt F. Kollbrunner and W. Wyss, Heft No. 16, Mitteilungen über Forschung und Konstruktion im Stahlbau, Verlag Leemann, Zurich, Switzerland.

ISSUES INVOLVED IN A UNIFIED AND COORDINATED FEDERAL PROGRAM FOR TRANSPORTATION—A Report to the President. The Secretary of Commerce, Washington 25, D. C.

BASIC MODELS FOR TECHNICAL DRAWING—Bulletin No. 115, Texas Engineering Experiment Station, College Station, Texas.

THE CONSOLIDATION OF SOIL—A Study of the Performance of Plant, Road Research Technical Paper No. 17, Road . . .

(Continued on page 51)

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for handling of low slump concrete containing large aggregates and air-entraining agents

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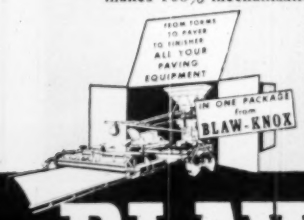

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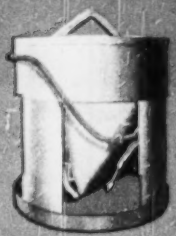

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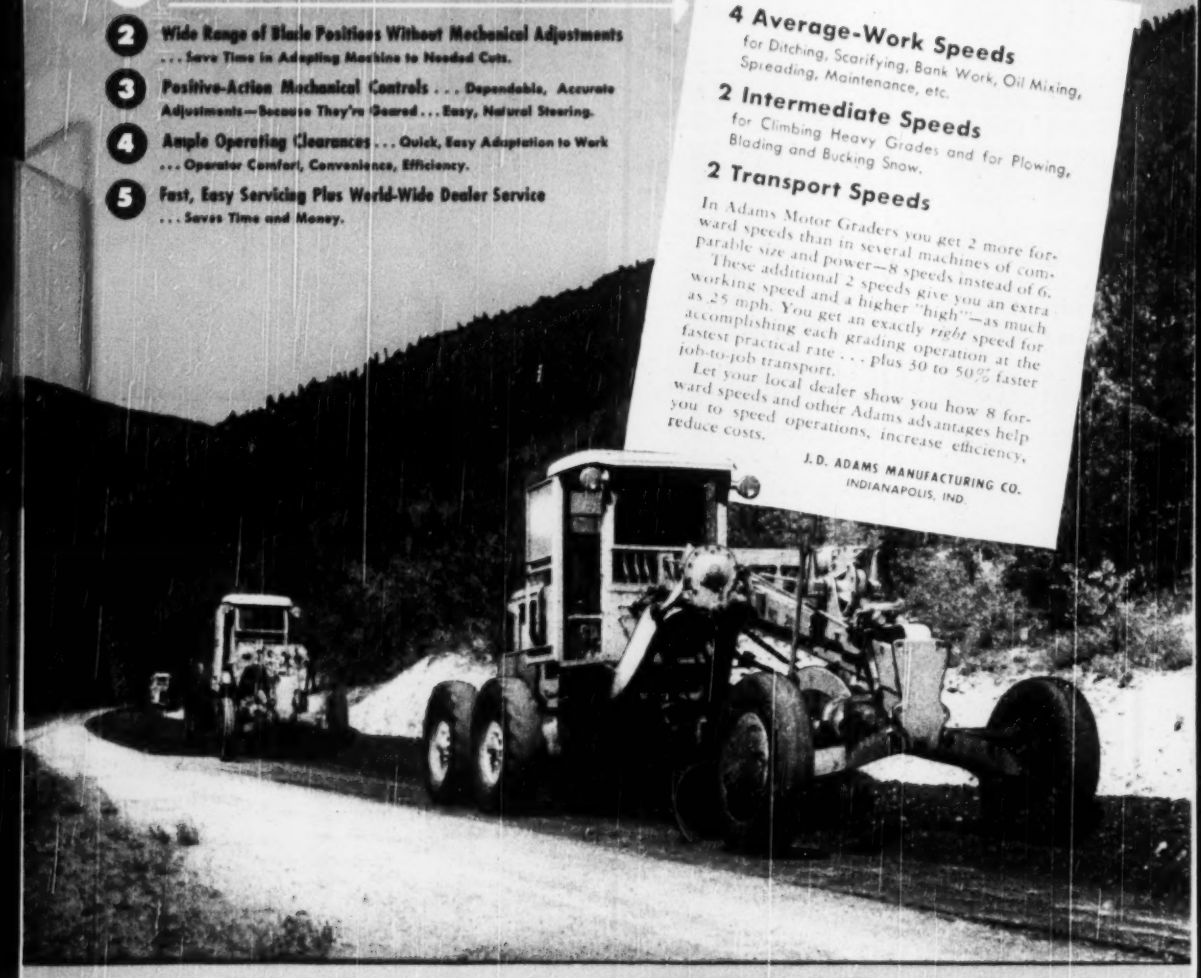

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(Continued from page 48)

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CORROSION OF DRAINAGE WELLS AT SARDIS DAM, MISSISSIPPI—Technical Memorandum No. 3-257. Waterways Experiment Station, Vicksburg, Mississippi. $1.

THE FINANCING OF HIGHWAYS BY COUNTIES AND LOCAL RURAL GOVERNMENTS 1931-1941—Bureau of Public Roads. Superintendent of Documents, Washington, D.C. 45¢.

MODULAR COORDINATION: WHAT IS IT? HOW DOES IT WORK? WILL IT HELP REDUCE HOUSING COSTS?—Housing & Home Finance Agency, Office of the Administrator, Washington, D.C. 15¢.

FUSSTUBFLACHEN FUR TRAGERROSTE, 1. TEIL: TRAGERROSTE UBER EINER OFFNUNG—By H. Homberg. Selbstverlag des Verfassers, Westfalen, Germany.

BUCKLING OF COMPRESSED STEEL MEMBERS. Transactions of the Royal Institute of Technology, Stockholm, Sweden. Price 10 Kronor.

FLOOD DISCHARGE RECORDS RELATING TO PENNSYLVANIA STREAMS—Department of Forest and Waters, Harrisburg, Pa.

TENTATIVE STANDARD SPECIFICATIONS FOR SODIUM CHLORITE—American Water Works Assoc., 500 Fifth Ave., New York 18. Price 20¢.

LOAD CARRYING CAPACITY OF ROADS AS AFFECTED BY FROST ACTION—Research Report No. 10-D. Highway Research Board, Washington 25, D.C.

TEMPERATURE STRESSES IN CONCRETE PAVEMENTS—Swedish Cement and Concrete Research Institute at the Royal Institute of Technology, Stockholm.

CONCRETE KERBS, CAUSES AND PREVENTION OF FAILURES—Road Research Technical Paper No. 15. Road Research Laboratory, Department of Scientific and Industrial Research, London, England. Price 9d.

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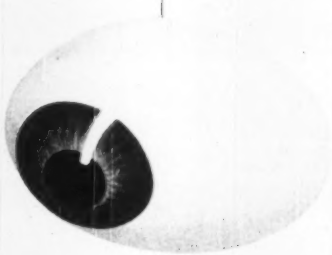

Yes, meeting contract deadlines depends on *many* factors...and one of the most important is the *quality of the lubrication* your machines get. For lubrication is more than just "oils and greases"... it's also knowledge of your equipment, the right lubricants to use for it, and how to use those lubricants to best advantage.

That's why you'll do better with Socony-Vacuum *Correct Lubrication*. It's a *complete* program of lubrication—designed specifically for your equipment and operating conditions to step up efficiency, speed work-progress, reduce both maintenance and lubrication costs.

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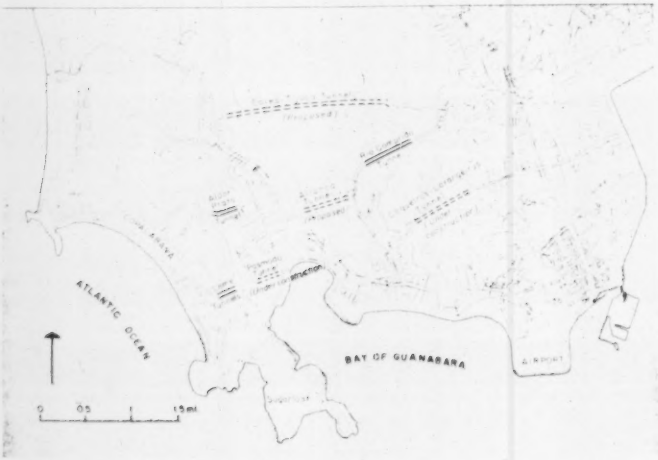


Under the granite hills Rio tunnels connect city centers

With four vehicular tunnels in service, built-bound Rio de Janeiro will witness the opening of another next year, and a sixth in 1952-53.

The last will be the largest so far—a 1,250-meter tunnel driven through hard rock to connect the Laranjeiras residential district directly with the central business section.

In addition, a 3,500-meter "super tunnel" is in the planning stage to cut under Mt. Corcovado to connect outlying Gavea with the city's Tijuca section.

Hills have always been a mixed blessing to Rio. They provide her with breathtaking views of solid granite peaks, but they have been an increasing barrier to traffic as the city grew. Several small hills in the city proper have been leveled in the past, and in June the demolition of Santo Antonio hill in the heart of the business district was started. (ENR March 16, p. 43).

The first tunnel dates back to the 1880's and the old Brazilian Empire. Running through a hill in the Rio Comprido section it is 200 meters long, 10 meters wide and 5.6 meters high. About 20 years later, the Alaor Prata tunnel was driven 180 meters through a hill separating the Botafogo and Copacabana sections and in 1923 this tunnel was expanded to 15 meters in width and 6 meters in height. It will be widened further in a few years. Next year a new tunnel from Botafogo, to be called the Pasmado, will feed into the Leme tunnels and do away with a congested approach which now serves these tubes from the city side. This new tunnel will be 210 meters long, 20 meters wide and 6.3 meters high. The tunnel itself is completed and paving and lining are to start soon.

The most ambitious job under way at the moment is a 1,250-meter tunnel connecting Laranjeiras with the Catumbi section of the city. More than 900 meters have been finished to full width, after the pilot tunnel was completed.

In general, construction follows standard procedure in hard rock tunneling. A pilot tunnel is driven first and then expanded to requirements.

The newer tunnels are faced with marble and white reinforced concrete.

American engineers plan 11-story hotel for Rome

Guy B. Panero, Engineers, of New York City, have been selected by Societe Generale Immobiliare to perform engineering services for one of the largest hotels to be constructed in Rome since the end of the war.

Representatives of the Panero firm are now in Rome making preliminary engineer studies for the new 11-story hotel. It will contain 413 guest rooms and suites in addition to a residential wing that will contain 62 apartments. A basement and two sub-basements are also included in the present plans.

The entire building will be air conditioned, the system designed to allow individual temperature control in each of the guest rooms. Other mechanical facilities will be comparable with those of modern hotels in the United States.

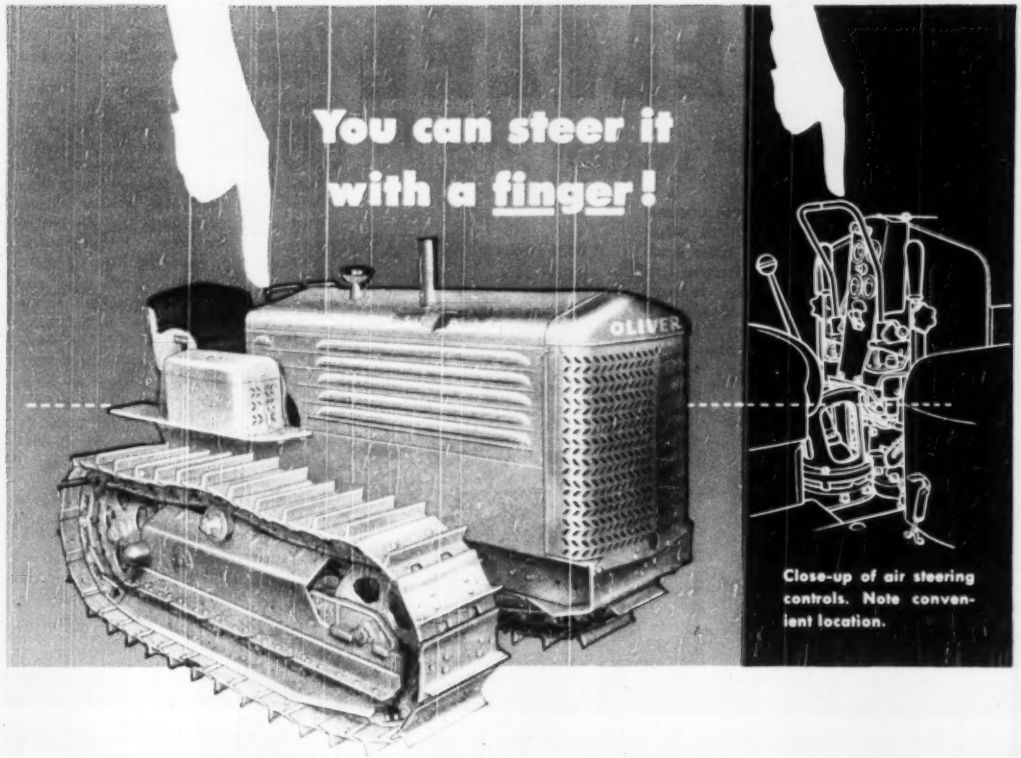
Foreign Briefs

American experts help—The International Bank for Reconstruction and Development announces that, at the request of Turkey, a 12-man team of specialists, headed by James M. Barker of Chicago, is undertaking a survey of the Turkish economy to outline a program and to propose action to contribute to that country's economic progress. Herman G. Baity, professor of sanitary engineering in the University of North Carolina School of Public Health, is serving during the summer as sanitary engineering consultant with a Brazilian commission beginning the development of the Sao Francisco River valley along lines of the Tennessee Valley Authority. This is his fifth tour of service in South America with the Division of Health and Sanitation of the Institute of Inter-American Affairs. And Prof. Forest H. Green, of the School of Civil Engineering and Engineering Mechanics at Purdue University, has been assigned by the United States State Department to aid Egypt in rebuilding its road system.

Engineering in Biblical lands—A reservoir capable of storing 600 million cu ft of water will be built shortly in Lower Galilee to provide large-scale irrigation in the Jordan Valley, the Yavniel Depression and Lower Galilee. It will cover 3,500 acres. A hydroelectric station is also to be built. Construction of the reservoir is closely linked with reclamation of the Lake Hule swamps and deepening of the Upper Jordan river bed. The Ministry of Agriculture, which is carrying out the work, also plans to build another reservoir north of Nazareth and to link the two reservoirs by open channels.

Venezuelan steel plant—The Venezuelan Development Corp. has given orders for the erection of a modern steel plant following studies on the possibility of building up an iron and steel industry in Venezuela. The plant should be able to turn out 200 tons of steel daily. The decision to build up an iron and steel industry in Venezuela is based on recommendations made by the corporation that heavy industry is vital for the progress of the country, that an iron and steel industry must be based on ir

(Continued on page 56)



Here's a good "steer" in tractors... the Oliver Model D Crawler and its new *air steering.** This new finger-tip steering makes life easy for the operator . . . cuts down fatigue and lets him get more done per day.

Two conveniently located steering levers can be operated at the touch of a finger . . . assure instant, positive steering control. A compressor mounted to the front of the engine block and driven by the fan belt does all the hard work.

In addition to new air steering, the Model D brings you other outstanding advantages that add up to more money in your pocket. 61.2 H.P. in the gasoline model and 61.19 H.P. in the Diesel Model; 4 forward and 2 reverse speeds; exclusive Oliver steering principle that keeps power on both tracks at all times; rugged, sound construction; easy operation and maintenance are among the many Oliver features that make the Model D the top choice among men who want value for their tractor dollar.

For complete details, see your Oliver Industrial Distributor or write The OLIVER Corporation, Industrial Division, Cleveland, Ohio.

*Available as optional equipment.

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A complete line of industrial wheel and crawler tractors

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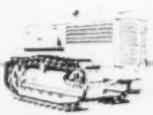

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Demand for Heltzel forms comes from experienced contractors who know Heltzel forms save time and money. TIME — because firmer installations can be made faster. MONEY — because Heltzel equipment lasts longer and involves less labor on the job. The example below of a flexible form is typical of Heltzel better built forms.

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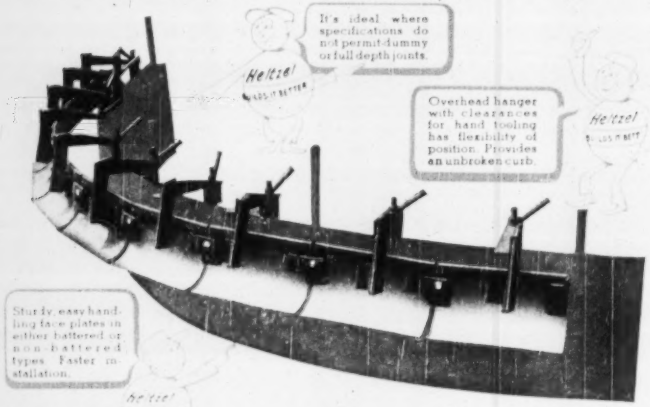
It's ideal where specifications do not permit dummy or full depth joints.
Overhead hanger with clearances for hand tooling has flexibility of position. Provides an unbroken curb.
Sturdy easy handling face plates in either battered or non-battered types. Faster installation.

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The only flexible form with three alternate methods of support. (1) Full depth division plates. (2) Skeleton division plates, and (3) Overhead hangers. All Heltzel forms improve contractors' operations; because they speed up job while making the work easier.

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Before you buy, before you start a job — check with Heltzel! Heltzel better built curb and gutter forms in standard types will save for you. Special shapes designed by Heltzel to job specifications make difficult jobs click like run-of-mine work. Write for information now.

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tional raw materials. The Engineering Corp. of Salem, Ohio, has been engaged as consultant to the Venezuelan corporation.

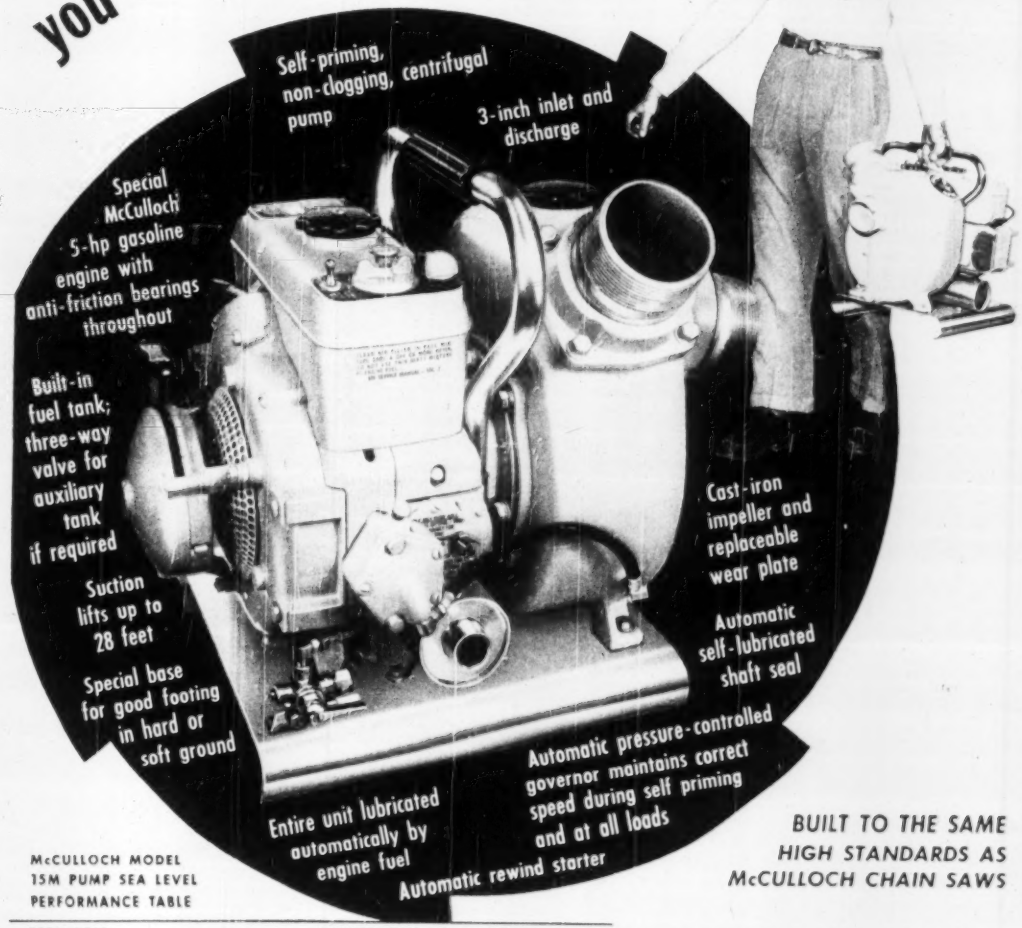
South African power—The Electricity Supply Commission is to build another big power station to supply power to the Witwatersrand. Near Coalbrook, in the north western Free State, it will be a coal pithead station, drawing supplies from the Clydesdale colliery. The new station, called Hambos, will have the biggest generating sets, boilers, transformers and switchgear of any power station in the Union, and orders have been placed in Britain for four 60,000 kw generators, and four boilers capable of evaporating 550,000 lb of water an hour, as well as the auxiliary equipment. The new station was designed in Johannesburg by the commission's own engineering staff.

Building research congress—A congress on building research will be held in London, England, Sept. 11-20, 1951, to review the progress made in research on architecture, building and the associated branches of civil engineering. Subjects to be discussed include: The effect of summer and winter conditions on the heating and cooling of buildings; the lighting of buildings; problems of special types of buildings, particularly schools, hospitals and factories; the acoustics of auditoria and broadcasting studios; merchandization of building operations; prefabrication; steelwork design; concrete design; soil mechanics and the design of foundations; weathering and durability of building materials in temperate and extreme climates; lightweight concrete; quality control and accelerated curing of concrete; development in manufacture and the structural use of burnt clay products; stone for housing and developments in quarry mechanization; gypsum products; limes; and pointing. Further particulars are available from the Organizing Secretary, Building Research Congress, 1951, Building Research Station, Backhill's Lane, Garston, Watford, Herts, England.

Jamaica development—An agricultural development corporation, rehabilitation works in Western Kingston, swamp reclamation and anti-erosion measures throughout the island are major projects proposed by the Jamaican House of Representatives Committee on unemployment. The committee decided these should be financed by a 50-year loan, which it proposed should be negotiated with the British government, and a fund which the committee proposed should be raised in Jamaica from taxation and other sources.

Here's a 15,000 GPH Pump you can carry in one hand!

Engine and pump together weigh only 57 pounds


Self-priming, non-clogging, centrifugal pump
3-inch inlet and discharge
Special McCulloch 5-hp gasoline engine with anti-friction bearings throughout
Built-in fuel tank; three-way valve for auxiliary tank if required
Suction lifts up to 28 feet
Special base for good footing in hard or soft ground
Cast-iron impeller and replaceable wear plate
Automatic self-lubricated shaft seal
Automatic pressure-controlled governor maintains correct speed during self priming and at all loads
Entire unit lubricated automatically by engine fuel
Automatic rewind starter

BUILT TO THE SAME HIGH STANDARDS AS McCULLOCH CHAIN SAWS

McCULLOCH MODEL 15M PUMP SEA LEVEL PERFORMANCE TABLE

TOTAL HEAD INCLUDING FRICTION	HEIGHT OF PUMP ABOVE WATER 10 Ft.	15 Ft.	20 Ft.	25 Ft.
20 ft.	250 GPM			
25 ft.	245	210 GPM	170 GPM	
30 ft.	235	205	165	130 GPM
40 ft.	215	190	160	125
50 ft.	185	165	145	120
60 ft.	135	130	125	105
70 ft.	65	65	65	60

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Please send me complete details on the McCulloch Model 15M Pump.

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KOEHRING 2½-yard 1005 has plenty of power, stamina and weight-stability to hold solidly when digging into the toughest rock banks. It's *specially-engineered* for heaviest 2½-yard service.

Every operating assembly, from the 1005's cast-alloy crawler shoes to boom point, is extra-heavy-duty to meet the typical strains of 2½-yard digging. Crawler frames and axles are separate units from the carbody . . . provide "give" in the excavator base. Crawlers are easily moved in for shipping clearance. Positive traction-brake steering provides exceptional maneuverability. Center pivot bearings protect vertical traction shaft from horizontal stresses . . . husky hook rollers resist vertical stresses. Compact upper machinery, on one-piece turntable, is simple, accessible.

Big 37", double-band swing clutches are self-equalizing. Clutch housings constantly rotate, dissipate heat, give smooth, cool operation. Entire machine is 100% mechanical . . . no complicated hydraulic or air systems requiring service specialists. Adjustments are easily made by operator.

Operators also like the way the 1005's big, 48" power clutch retains "feel" of load . . . with only 1/10th the normal lever pull. Another Koehring feature, instantaneous dipper trip, works every *time* . . . saves spillage . . . speeds loading for top yardage output.

This heavy-duty Koehring 1005 is diesel powered, can also be furnished with electric motor. Quickly converts from shovel to dragline, clamshell or lift crane. Safely lifts up to 79½ tons . . . boom sections up to 120', plus 30' jib. Other Koehring excavator sizes: ½-yd. 205, ¾-yd. 304, 1½-yd. 605.

YOUR KOEHRING DISTRIBUTOR HAS ALL THE FACTS . . . CHECK THIS 2½-YD. 1005 TODAY

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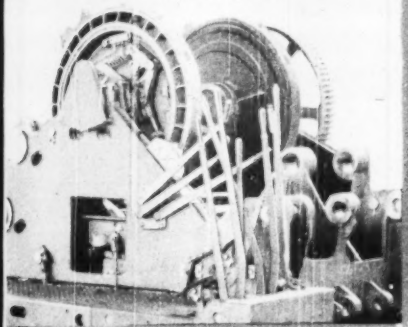
- EVERY ASSEMBLY HEAVY, POWERFUL . . . *ENGINEERED SPECIALLY* FOR 2½-YARD EXCAVATOR SERVICE
- PLENTY OF WORKING WEIGHT BEHIND POSITIVE CHAIN CROWD FOR *DIGGING-IN*
- RIGID BOX-DESIGN BOOM, MASSIVE SHOCK ABSORBER MOUNTING, DOUBLE DIPPER STICKS, TORSION-RESISTANT SHIPPER SHAFT, ALL ABSORB STRESSES OF FAST ROCK HANDLING WITH THE 1005
- SAFELY LIFTS UP TO 79½ TONS Boom sections are available up to 120' . . . plus 30' jib
- LIGHT LEVER PULL SETS BIG 48" POWER CLUTCH . . .



Power-actuated clutch takes only 1/10th the pull required to set a manual clutch of comparative size . . . yet, retains "feel" of load. Heat compensator spring controls power output . . . automatically adjusts clutch for heat expansion. This Koehring power clutch also can be easily converted to full manual control when necessary.

250 TRENCHLINER* has 30 digging speeds . . .

Here's a fast, powerful Trenchliner that gives maximum efficiency in any material short of solid rock. Model 250 has 30 digging speeds from 3 to 117" per min. Digs up to 12½ ft. deep . . . 16 to 42 in. wide. Ladder-type boom shifts to extreme right or left . . . cuts to within 11 in. of side obstructions. Other models: 200, 221, 310 . . . and the rubber-tired utility-size, mobile Model 80.

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ELEVATING CHARGER for batch or transfer plant

Johnson's new Elevating Cement Charger has size 14, 1000-lb. cap. cement weigh batcher, hung under a 33-bbl. cap. overhead storage hopper. Upper hopper can be equipped with two 1000-lb. weigh batchers, for charging dual-batch trucks. Adapted from batch to transfer plant by adding 50-bbl. extension hopper. Easily moved, set up by dump truck . . . no crane needed.

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Big-production, Kwik-Mix 11-S Dandie gives top-quality concrete mix, saves time every batch. Re-mixing drum folds as it mixes . . . 85 times every minute. Exclusive Flow-line Discharge Chute reaches deep into drum, discharges full 12.1-ft. batch in 7 seconds. Side or end discharge. Also available with tower loader. Other Dandie sizes: 3½S, 6-S, 16-S.

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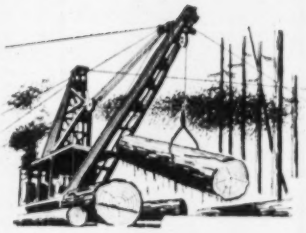
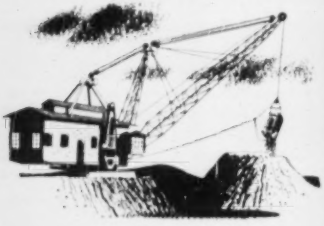
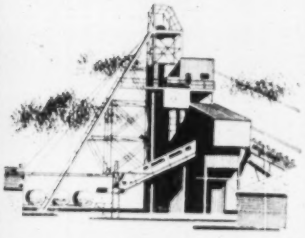


For logging operations, tough flexible ropes for tractor arch lines, chokers, skidders and loading.

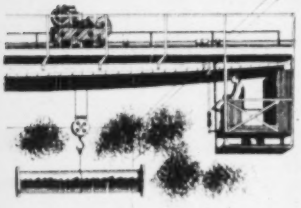


For shovels and draglines, ropes for different sizes and types of equipment designed to give best service for your particular needs.

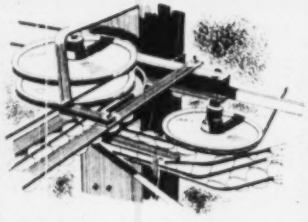
The right rope for each job is available from



For shaft mining, shallow or deep, internally lubricated ropes to meet all load and speed requirements.



For cranes and hoists, small or large, *PRE*formed Internally Lubricated wire ropes of the correct size and flexibility for each use.



For can conveyors, there are bright carbon steel, stainless steel and monel metal wire ropes to meet various service conditions.

A thousand and one
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Internally Lubricated
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It pays to choose the right rope for your equipment

Besides the ropes listed above, Macwhyte makes many more such as cable tool drilling lines, elevator cables, incline or haulage ropes, scraper ropes, aircraft control cable assemblies, ropes for ship rigging and guying work, as well as hundreds of sizes and types of single-part, round-braided or flat-braided slings for material handling.

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MACWHYTE COMPANY 2930 Fourteenth Avenue, Kenosha, Wisconsin Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope. Our distributors and mill depots carry stocks for immediate delivery. Mill Depots: New York • Pittsburgh • Chicago Minneapolis • Fort Worth • Portland • Seattle • San Francisco • Los Angeles

MUNICIPAL AFFAIRS

THE BUSINESS DISTRICT of Milwaukee, and the Milwaukee River. Milwaukee Harbor is considered the most beautiful on the Great Lakes. Milwaukee is the leading car-ferry port of the world, and ranks high as a coal, grain and general cargo port.

Milwaukee considers 35-mile expressway system

A 35-mile network of express streets and highways is proposed for Milwaukee, Wisconsin's marketplace. Consultants are to be hired to plan two expressways, one an east-west route and the other on 44th street. These high-speed arteries are planned to relieve congestion and ease flow of over-the-road commerce.

Milwaukee is 49.4 sq mi in area and its population is about 645,000. Its wholesale trade sphere includes the entire state as well as the upper peninsula of Michigan. The principal items handled by Milwaukee County wholesalers and jobbers are the staple lines such as foods, drugs, hardware and house furnishings. The aggregate volume of business in 1949 was $808,000,000. In that year retailers of the county recorded a volume of $739,100,000.

The inner harbor, formed by the Milwaukee, Menomonee and Kinnickinnic rivers, and its municipal outer harbor development on the Lake Michigan front represent a $80,000,000 investment.

The city has a model water purification project which cost $5,500,000 and has a capacity of 200,000,000 gpd. The municipally-owned and operated water system supplies more than 115,000,000 gpd to about 700,000 consumers through a system with more than 1,000 miles of mains.

The $1,500,000 sports arena just completed seats 11,000.

The city, the county, the school board, and the metropolitan sewerage commission have about $25,000,000 at their disposal in new cash for construction projects in 1950—housing, hospitals, sewerage, schools and other public buildings.

How one-way streets speed Portland traffic

A new one-way street plan in Portland, Ore., according to the Automotive Safety Foundation, has raised the average speed of traffic flow in the downtown district from six miles an hour to 14 or 15.

Covering about 21 miles of streets, the one-way grid plan was put into effect recently after careful study and planning under the direction of Fred T. Fowler, city traffic engineer. In addition to proving its technical value, the plan has won public favor. A newspaper-sponsored poll showed that 77 percent of the people considered it an improvement.

Portland's business district is made up of 200 square blocks, with 50-ft curb-to-curb width on north-south

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You can put complete reliance on what your WEINMAN representative tells you about your pumping requirements. His recommendations are based on years of "shirt sleeve" engineering experience in applied hydraulics. They are backed by an organization where every key man has at least 25 years of concentrated experience with one product—PUMPS. His recommendations are free for the asking and you incur no obligation. Just write, wire or phone.

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The WEINMAN Unipump

For use where space is limited . . . may be mounted in any position . . . very compact. Capacities 10 to 1000 G.P.M. Heads to 500 feet. For informative bulletin on UNIPUMPS, fill out the coupon below.

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I would like to learn more about WEINMAN Unipumps. Send Bulletin 720-C to

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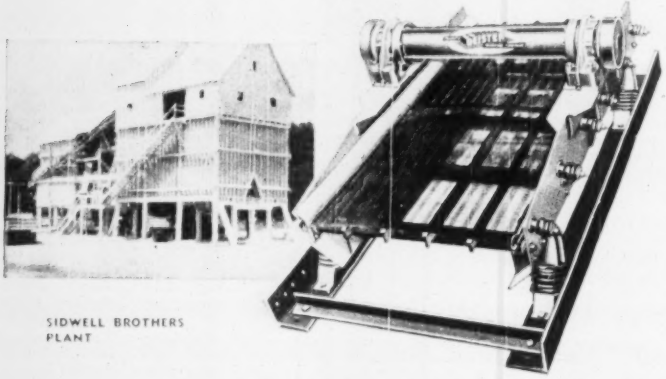
1st

Production report on New Deister Ag-Lime Screen



SIDWELL BROTHERS PLANT

One year ago, we released one of our new Ag-Lime Screens for production tests to Sidwell Brothers, Deavertown, Ohio. It performed so well that a second screen was added later.

Carl Sidwell sums up the exceptional all-round performance of the Ag-Lime Screen this way:

"As you know this is a very hard stone to screen. You really helped to solve our problem when you came out with this light-weight, steep-incline and high-speed screen. They are doing a very good job."

Both of the revolutionary Ag-Lime Screens at Sidwell are equipped with 1/8" square opening cloth and .041" diameter wire. Screen Number One is fed 30 tons an hour, with 10 tons going through. Moisture content is 1½ to 4%. Largest particle in feed is 1 inch.

Ag-Lime Screen Number Two receives 35 tons an hour, with 15 tons going through. Moisture content is ½ to 1½%. Screen cloths last an average of five months.

This is high-capacity handling and accurate sizing of damp sticky materials without blinding. The new Deister Ag-Lime is revolutionary: lighter in weight, operates on a far faster stroke cycle—especially designed to handle ag-lime and other damp fines. The experience of Sidwell Brothers is proof enough that for economical screening of agricultural limestone, you can't beat the new Deister Ag-Lime Screen. For particulars, write for Bulletin No. 51 today.

DEISTER SCREENS

DEISTER MACHINE COMPANY

FORT WAYNE 4, INDIANA

avenues and 36-ft. width for east-west streets, and with curb parking on both sides of the street. Traffic delays were caused by street car and bus loading, left turn movements, and the primary signal delay due to the impossibility of progressive timing under two-way operation. Even with left turns banned at a majority of the downtown intersections, evening rush hour traffic moved at an average speed of under six miles an hour.

The change-over to one-way street operation was accomplished in two steps. First, the north-south avenues were marked for three moving lanes, assigning two to the direction of future one-way movement and one to the opposing traffic. Signals were retimed for a 15-mile per hour progression in the direction of future travel. Travel in the correct direction was made so advantageous that drivers quickly became accustomed to picking a route conforming with the one-way grid movement. After this advance training, the second step of actual changeover to one-way traffic was made without confusion, Mr. Fowler said.

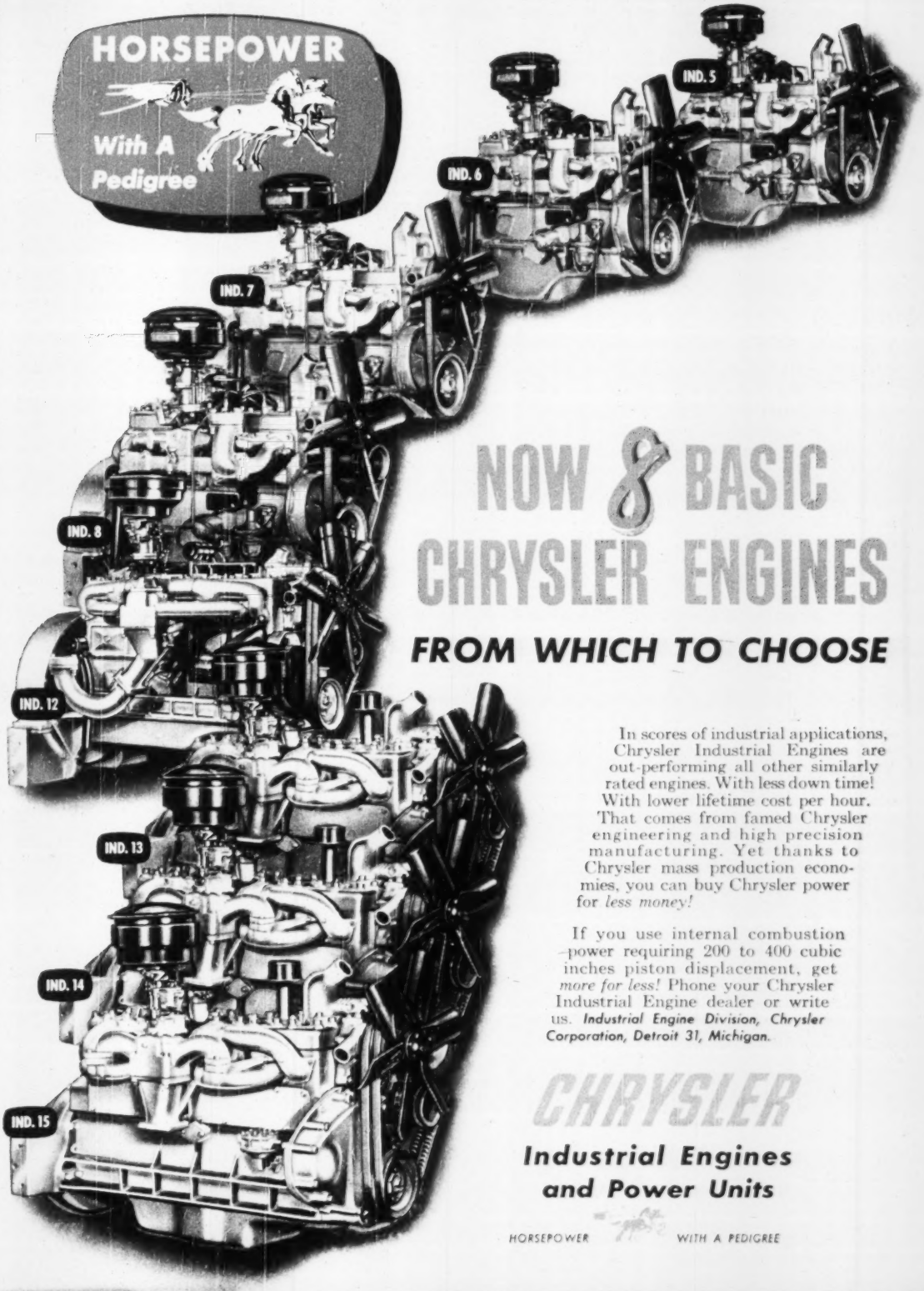
Municipal Briefs

Quake protection—Proposed building code amendments which would provide for increased horizontal and vertical bracing as a protection against earthquakes have been recommended to the Seattle, Wash., city council by the Puget Sound Engineering Council. One provision would forbid the use of lime mortars in any masonry construction.

Water and sewer study—Engineering studies of the sewer and water problems in metropolitan Erie, Pa., are in prospect as the first step in a possible $1,000,000 expansion. The city sewage plant is confronted with the need for twice as much as its 18,000,000-gal. capacity. Suburban commissioners agreed it would be more advantageous to unite for an expansion of the city's facilities than to build their own water and sewage plants.

Smokeless roundhouse—It is said that the opening next month of the new Cote St. Luc freight terminal of the Canadian Pacific Railways will cut by 85 percent the smoke which is now putted out into Montreal's atmosphere. This is accomplished by a direct steaming plant which is so equipped that after being steamed up engines will hold their steam pressure in the boiler by a pilot valve, and the coal will be fired by a special process, eliminating excessive smoke.

(Continued on page 66)



NOW 8 BASIC CHRYSLER ENGINES

FROM WHICH TO CHOOSE

In scores of industrial applications, Chrysler Industrial Engines are out-performing all other similarly rated engines. With less down time! With lower lifetime cost per hour. That comes from famed Chrysler engineering and high precision manufacturing. Yet thanks to Chrysler mass production economies, you can buy Chrysler power for *less money!*

If you use internal combustion power requiring 200 to 400 cubic inches piston displacement, get *more for less!* Phone your Chrysler Industrial Engine dealer or write us. ***Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.***

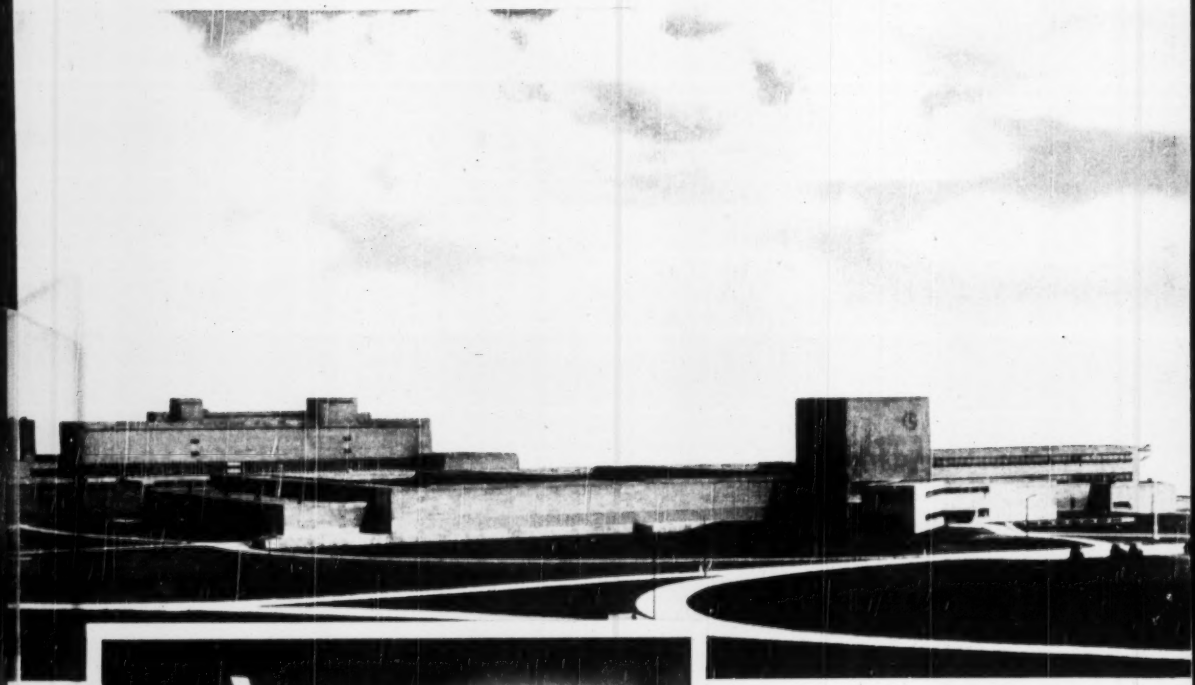
CHRYSLER

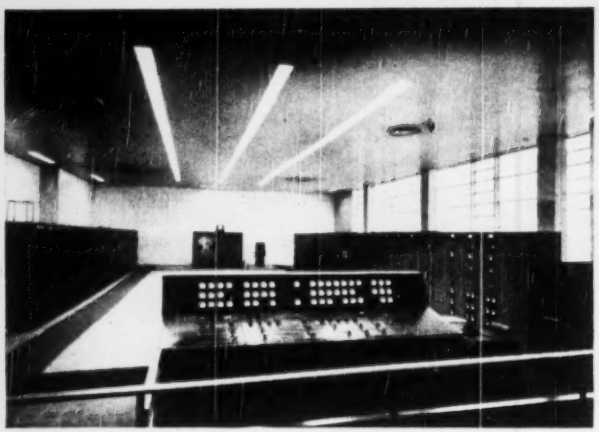
Industrial Engines and Power Units

HORSEPOWER WITH A PEDIGREE

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





The Chicago South District Filtration Plant shown here is the largest in the world, serving more than a million and a half people. The plant has operated at an hourly peak of 546 mgd with only 70 of the 80 filters in service.

This mezzanine switchgear room in the lower left pumping station is an example of the way Westinghouse designs and manufactures electrical equipment for a co-ordinated, efficient system. (Right) High-voltage switchgear gives necessary protection on incoming lines, as well as feeders, and supplies power to large pump motors and station transformers. (Left) Low-voltage switchgear controls station auxiliaries such as priming pumps, crane motor feeder and valves. (Rear center) Network protectors and 120/208-volt distribution for building lighting and miscellaneous power. (Front center) Control desk with mimic bus, indicating instruments and circuit breaker switches centralizes control of plant equipment.

Westinghouse

EQUIPMENT

FOR PUBLIC WORKS

Unit Responsibility

ASSURES WATER WORKS EFFICIENCY

For any water works, large or small, higher operating efficiency depends in part on your electrical manufacturer.

He should provide every type of electrical equipment . . . give you a co-ordinated engineering application . . . based on practical experience in water works electrification.

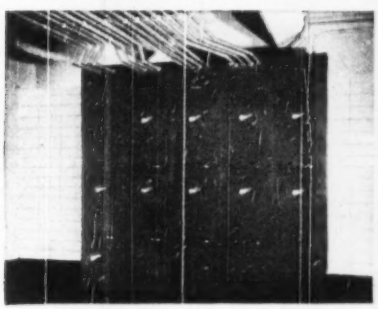
These elements add up to unit responsibility and mean reduced operating costs for your plant. You get them all from Westinghouse:

Westinghouse makes a complete line of electrical equipment for water works. This includes "Unitized" metal-clad switchgear; packaged power centers, power transformers and unit substations; control and control centers; motors and gearmotors, as well as other electrical apparatus and supplies.

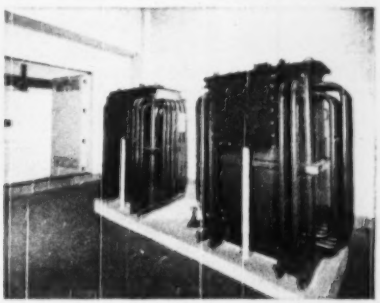
Westinghouse Consulting and Application Engineers are available to work with you. They will help you select and apply the right equipment to give you a co-ordinated, efficient electrical system.

Westinghouse brings you a background of long experience in applying electrical equipment to water works. The Chicago South District Filtration Plant, shown here, is but one more in a large list of outstanding installations where Westinghouse unit responsibility has been *proved* on the job.

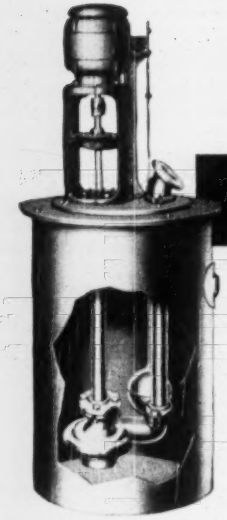
For help on your water works electrification problems, call your nearest Westinghouse District Office, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-96818



This control center on the third floor of the Chemical Building groups into one unit all the combination linestarters and motor control for fan motors, agitator drives and other auxiliary equipment in this plant area.



These two 300-kva, 3-phase, 60-cycle, 2300-120-208-volt, liquid-filled distribution transformers are located in the west pump room and supply power for the building lights and equipment in the Filtration Plant.



Every installation of a

YEOMANS DRAINAGE PUMP

builds prestige

▶ for the building

▶ for the architect-engineer

For simplicity of design, sturdiness of construction and excellence of workmanship, Yeomans Drainage Pumps are the first choice of experienced architects and engineers. As for building owners, it is significant that many Yeomans Drainage Pumps are purchased to replace inferior pumps—as a sensible means to put an end to further expense for service and repairs.

THERE ARE TWO TYPES OF PUMP

- YEOMANS BILGE PUMP—HEAVY DUTY, for handling drainage and wastes containing no solids.
- YEOMANS SCREENLESS EJECTOR, for handling wastes containing solids.

Each of these well designed, well built pumps is an acknowledged leader in its field, a fact which effectively guarantees dependability and trouble-free performance.

A full range of capacities from 10 to 5000 gpm. Heads to 75 feet.

To aid architects and engineers in selection of the proper pump for any installation, Yeomans maintains competent sales and service representatives in 50 cities. This organization makes available to you more than fifty years of Yeomans experience in analyzing pumping problems.

Sweet's Architectural and Engineering Files contain full information. Also available for your own Reference Files are helpful bulletins containing complete selection and installation data.

USE THE COUPON

BUILDERS OF DRAINAGE PUMPS FOR OVER 50 YEARS

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YEOMANS BROTHERS COMPANY
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Please send these bulletins:
No. 3005—Yeomans Heavy Duty Bilge Pump
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Camden sewage disposal—Camden, N. J., has approved a $8,250,000 bond issue for its new sewage disposal system and plant. The entire project is expected to cost $15,000,000.

Water pressure boosted—The biggest improvement in the water distribution system of Akron, Ohio, in 50 years has been completed after more than three years of work. It is the new 3-mile feeder line for South Akron homes and industries. The 24-in. pipe will improve pressure and volume.

Sewage disposal—Charles C. Spencer, director of environmental sanitation for the health department of Erie County, N. Y., reports that most townships have adopted or are ready to adopt ordinances covering sewage disposal along the lines recommended by the department. Under the ordinances, permits of occupancy for new homes and business places would not be issued by town authorities until sewage disposal facilities are approved. The object is to safeguard against the seepage of raw and untreated sewage into streams and bathing waters.

Water for Greater Ottawa—The waterworks department of Ottawa, Ont., is embarking upon a large expansion program for this year to ensure adequate water supply to the now greatly enlarged city area (ENR Feb. 25, page 54). A new 24,000,000-gal reservoir will cost $1,200,000 and a new 42-in. pipeline to cost $1,600,000 will connect the reservoir with the Lemieux Island filtration plant. Further new auxiliary lines and services will bring total expenditure to $4,265,593.

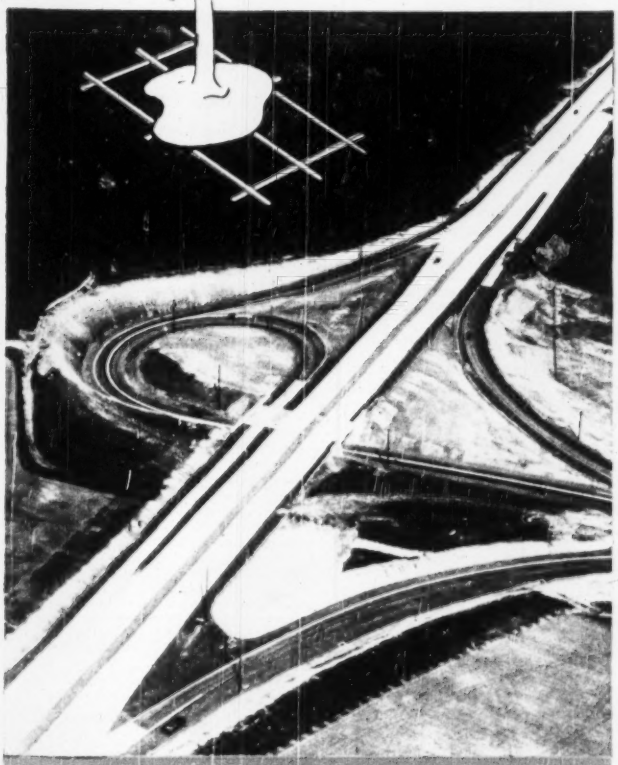
Mohawk cleanup—Eight communities have pledged their support to battle pollution of the Mohawk River and its tributaries in New York State.

Schenectady, Utica, Gloversville, Fort Plain, St. Johnsville, Peland, Rome and Scholarie are charter members of the Mohawk Valley Pollution Abatement Conference. Representatives organized the conference recently in Schenectady as an information clearing house and a coordinating agency.

Plentiful water—Houston, Tex., will have plenty of water this summer according to Frank N. Baldwin, utilities director. This ending of the water shortage Houston has experienced for several summers has been brought about by the addition of new water wells to the city's water system. Since March, 1949, daily supply has been increased by 24,000,000 gal. In two more months, six new wells will be added, increasing the daily supply by 18,000,000 gal to 113,000,000 gal.

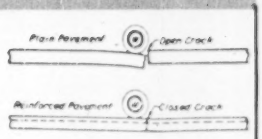
On the Pennsylvania Turnpike

American Welded Wire Fabric



Longer paving slabs, fewer joints, improve riding qualities on concrete highways reinforced with American Welded Wire Fabric. Reduced rate of cracking, prevention of heaving and spalling, also reduce maintenance costs, increase service life of the highway.

As the wheel load approaches an open crack in plain pavement, one slab end carries the entire load. As the wheel load approaches the closed crack in pavement reinforced with American Welded Wire Fabric, both slab ends, instead of one, carry the load, preventing damage to the slab and to the subgrade.



THE men who plan and build our modern concrete superhighways have helped to make American Welded Wire Fabric the world's most widely used reinforcement for pavement construction.

American Welded Wire Fabric keeps cracks that may form tightly closed—preventing progressive damage—distributes stresses, strains and impact in all directions.

U·S·S American Welded Wire Fabric reinforcement in rolls or in flat sheets is easily handled, lies flat and stays in place. This means important savings in labor costs and construction time.

Standard styles of U·S·S American Welded Wire Fabric are available in every locality from jobbers' stocks when furnished in rolls. When flat sheets or special styles of fabric are required—you can depend upon our Donora, Pa. and Joliet, Ill., mills to maintain your construction schedules.

When you are planning any type of concrete construction, our technical staff will supply complete data on specific designs and standard styles of fabric that are most readily available. Literature containing valuable information is also available. Write to our nearest sales office today, you incur no obligation.

AMERICAN STEEL & WIRE COMPANY
GENERAL OFFICES: CLEVELAND, OHIO

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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Every concrete paving job needs

AMERICAN WELDED WIRE FABRIC

reinforcement

USS

UNITED STATES STEEL

Rubber-tired TOURNADOZER

Push-loading Scrapers in CUBA

Cia. Azucarera Vertientes—Camaguey de Cuba uses its Tournadozer to push-load Tournapull-Scrapers on construction of earthfill irrigation dams, also to build roads and clear firebreaks, on Central Estrella plantation, near Cespedes.

Dozing railroad grade in BRAZIL

On relocation of the Estrada de Ferro Sorocabana rail line, between Tatui and Itapenitinga, in the State of Sao Paulo, Brazil, this rubber-tired Tournadozer handled all preliminary grading along 18 miles of right-of-way. It cut down steep banks, cleared trees and brush, leveled dump areas and traveled at high speed from one task to the next. The Tournadozer is owned by the Brazilian contracting firm, Morais e Ferreira e Ferreira, Ltda., of Butucatu, Sao Paulo State, who also used a fleet of 3 LeTourneau rubber-tired Tournapulls on this 1,300,000 cubic yard railroad project.

Clearing landslide in COLOMBIA

Recently a heavy landslide completely blocked a main Colombian highway near Viota, 62 miles south of Bogota. It had to be cleared—*fast*. A big Tournadozer was located 103 miles away, working on highway maintenance at Alban, Colombia, for the Zona de Bogota. The mobile, rubber-tired bulldozer drove to the scene through heavy highway traffic, and cleared the entire 4,000 cubic yard slide of wet earth and rock, in a total of only 20½ hours traveling and working time. By any other method, this accomplishment would have required many men and, many additional hours of delay.

HIGH-SPEED, RUBBER-TIRED EXCAVATING • HAULING • LIFTING EQUIPMENT

combining tractor power with truck speeds

earns world-wide acceptance

As an example of the world-wide acceptance of Tournadozer, note these typical Latin American installations. Since its introduction over three years ago, this revolutionary LeTourneau bulldozer has also been thoroughly job-proved in scores of other foreign countries, and throughout Canada and the United States.

Tournadozer combines the power of a tractor with truck speeds . . . is the first bulldozer on rubber, designed as a unit, specifically for pushing and dozing. It provides speeds and mobility never before available for dozer work. Travels up to 19 m.p.h. Drives anywhere under its own power . . . cross-country, over paved highways, or city streets. 186 horsepower harnessed to all four wheels also gives Tournadozer added usefulness as a prime mover, wherever pulling power is needed.

If you haven't checked recently on what this multi-purpose bulldozer can do on your dozing, pushing, and pulling jobs, better find out what its unique power, speed and mobility can mean to you. Your LeTourneau Distributor has all the facts . . . and can also show you a full line of special, auxiliary Tournadozer tools that will further increase your profits. Call him, or write us NOW.

Pulling equipment in VENEZUELA

Normally, this Tournadozer excavates channel changes, digs drainage ditches and cleans up around shovels for T. Sanz & Cia., near Sabana de Mendoza, in Western Venezuela. Between dozing assignments, T. Sanz & Cia. utilizes Tournadozer's pulling power to speed loading of their Tournapull-Scrapers. Tournadozer's fast travel speed, rubber-tired mobility, and 186 h.p. make it an ideal prime mover for pulling Rooters, plows, rollers, sprinklers, blade graders. It also tows flat-bed trailers, for transporting heavy equipment and supplies around the project, or job-to-job. Travels on or off pavement.

Pioneering roadway in MEXICO

Working in temperatures of 105°, and isolated from nearest point of communication by 40 miles of rough, open terrain, this modern Tournadozer set a fast construction pace on a new highway across the remote desert country of Baja California. Project for the Mexican Federal Government called for movement of 190,000 cubic yards of material per month. The contractor, Constructores Mexicanos, of Mexicali, maintained this production with the dependable Tournadozer and LeTourneau high-speed, rubber-tired Tournapulls, which worked 20 hours a day on the difficult, cross-desert project.

R. G. LeTOURNEAU, Inc., PEORIA, ILLINOIS

MEN AND JOBS

Lt. Col. Henry Walsh has been assigned to Nashville, Tenn., as district engineer, succeeding **Col. Arthur W. Pence,** new division engineer for the Ohio River Division. Colonel Walsh is assistant division engineer for the North Atlantic Division in New York City. He began his military service in the Army early in World War I and spent several months overseas. In 1929 he transferred to the Corps of Engineers Reserve. In 1941 he was assigned as assistant district engineer to the Newfoundland district; in 1942 he became assistant division engineer for the North Atlantic Division and supervised the construction of airfields and military stations in Newfoundland and Labrador. In 1945 he was assigned to the Pacific Division as assistant to the division engineer, and later served under the Western Ocean Division as assistant chief of the Operations Branch, Honolulu District.

Guiton Morgan, civil engineer, has resigned as city manager of Austin, Tex.

Clifford M. Weber, construction supervisor District 5 of the California State Division of Architecture, retired April 14 after 38 years in the division. **Frank Austgen** will take over Weber's duties. Weber as a veteran of World War I. Some of the larger projects

(Continued on page 73)

Mrs. Emma Frances Barnett, 27, first woman registered structural engineer in Illinois is shown visiting a new building whose construction is supervised by Stephen Veller, structural engineer. Mrs. Barnett is employed by Chicago in its filtration plant design bureau. She was graduated from the college of engineering, University of Colorado, 1943.

VISITING WATER SOURCES—New York City's Delaware Water Supply System was the objective of a 250-mi field trip taken recently by the Junior Branch of ASCE's Metropolitan Section. Merriman Dam—now being faced with riprap—was one stop en route.

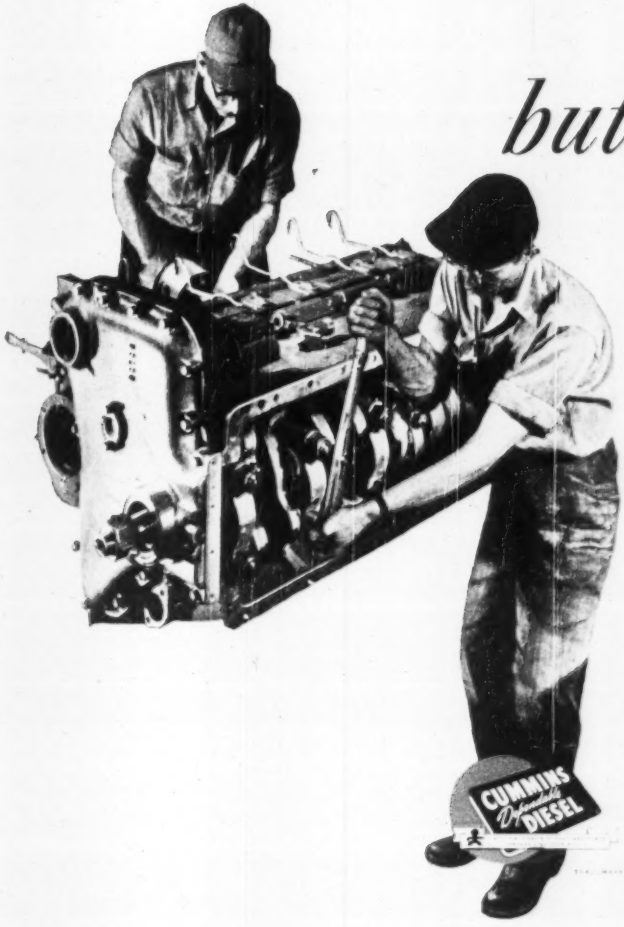
At the annual banquet of the West Virginia State Contractors Association in Charleston, Jennings Randolph, president of the airport division of the American Road Builders Association; Lt. Gen. Eugene Reybold, executive vice-president, ARBA; and Road Commissioner Ray Cavendish. Standing, left to right, Burton F. Miller, managing director contractors' division, ARBA; P. J. Walsh, executive secretary, West Virginia Contractors Association; Nello Teer, Jr., Durham, N. C., president construction, ARBA; Leo Vecellio, president of the West Va. CA; Col. W. T. Johnson, district engineer, U. S. Army Engineers, Huntington division; and John C. Cobb, Bureau of Public Roads, Charleston division.

Col. Arthur W. Pence, formerly district engineer at Nashville, Tenn., has become Ohio River division engineer at Cincinnati. He was commissioned in the Corps of Engineers in 1918 upon graduation from West Point. After extensive experience, including service as assistant to the division engineer in New York, he served five months as deputy chief engineer at Headquarters of the Services of Supply in the United Kingdom and later did important work in North Africa and Italy. In July, 1948 he became Chief of Staff at Fort Belvoir, Va.

Cummins® Custom-built Diesels

Built not once

but Twice



The better-built engine for more profitable power

Yes, they're actually built *twice*. That's what makes a lightweight, high-speed Cummins Diesel such an efficient, dependable, precision-made engine. After initial assembly, each engine is run-in on the test block. Then it is torn down and carefully re-inspected—after that it is re-assembled and tested *again* to assure *peak performance*.

The finest of engine craftsmanship . . . exclusive Cummins fuel system . . . engines that are "custom-built to fit the job" . . . make a Cummins Diesel a *better buy for your power needs*.

Contact your Cummins dealer. He has more facts to show you about making more profits with

Diesel power by CUMMINS

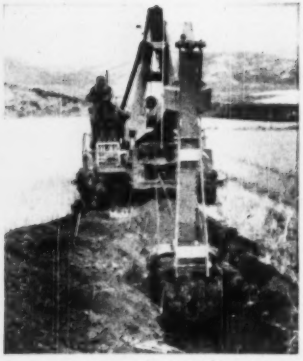
CUMMINS ENGINE COMPANY, INC. - COLUMBUS, IND.

EXPORT: CUMMINS DIESEL EXPORT CORPORATION
Columbus, Indiana, U. S. A. — Cable: Cumdiex

Lightweight High-speed Diesel Engines 50-550 hp. for: On-highway trucks · off-highway trucks · buses · tractors · earth-movers · shovels · cranes · industrial locomotives · air compressors · logging yarders and loaders · drilling rigs · centrifugal pumps · generator sets and power units · work boats and pleasure craft.

Hystaway Hoe Front

For use with Hystaways mounted on "Caterpillar" D8, D7 and D6 track-type tractors



Ditch digging is fast and efficient with the Hystaway Hoe. A narrow trenching bucket (23-in. cutting width) is available as optional equipment. Standard ½ yd. bucket is 33 in. wide.

A HIGH SPEED, rugged NEW EARTH MOVING TOOL for *ditch and trench digging and basement excavating.* DOES ANY JOB that a CONVENTIONAL ½ cubic yard hoe can do.

The Hystaway Hoe will dig to a full 15 ft. depth. It has MORE REACH than a conventional back hoe — an EXTREMELY FAST SWING — an actual EXCESS of POWER because of the "Caterpillar" diesel tractor engine which, even on the D6, has more horsepower than the engine on the average ½ yd. excavator.

The Hystaway, mounted on a "Caterpillar" D8, D7 or D6 track-type tractor with bulldozer, now provides five tools — dragline, clamshell, crane, shovel and the BACK HOE — and full tractor MOBILITY AND MANEUVERABILITY are retained. Current delivery. See your "Caterpillar" distributor.

HYSTER COMPANY

2953 N. E. Clackamas . . . Portland 8, Oregon

1853 North Adams Street . . . Peoria 1, Illinois

J. D. Armstrong, contractor of Ames, Iowa, won state and national A.G.C. Safety Awards for his 1949 record; now has a levee job on the Missouri River; also operates a heavy-hauling business; manufactures heavy trailers, special equipment for heavy construction.

---

he worked on were the Sacramento fair ground buildings, State Teachers' College, Arcata, and the Folsom State Prison.

Charles Stikeman of Great Neck, N. Y., a senior civil engineer of the N. Y. City Board of Transportation, who is retiring, was honored by 100 subway engineers and designers at a dinner recently. Mr. Stikeman has had a hand in the structural design of New York's subways since he started as a junior bridge engineer with the Public Service Commission in 1905.

Max L. Mitchell, Clinton, Ind., has been appointed engineer of a program to evaluate the water resources of Indiana. His work will be directed by the Indiana Flood Control and Water Resources Commission.

Jasper Meals, left, and E. E. Olsson talk over the new power plant of Ames, Iowa. Meals is resident engineer for Burns & McDonnell Engineering Co., Kansas City, Mo., the designers; Olsson is superintendent for Inter-State Construction Co., Kansas City, Mo., the contractors.

● Here's another typical money-saving fastening triumph for DRIVE-IT—fastening seat brackets at the Grand Rapids Speedrome.

Wherever steel or wood must be fastened to concrete, steel or other hard materials there's a spot for DRIVE-IT to save you money. Reports of 75% to 85% savings over old-fashioned methods are common. With Drive-It, a drive-pin plus a power charge does the job in a split-second—and *better* than the old "dig and drill" method.

We can't begin to tell you the whole story here, but do yourself a favor and send us the coupon below. It will be money in *your pocket!*

DRIVE-IT "300"

Distributors Coast to Coast

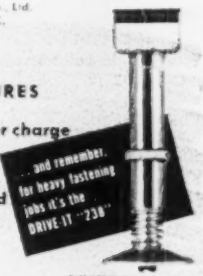
POWDER POWER TOOL CORPORATION

0703 S. W. Woods St., Portland 1, Oregon

(Canadian Distributor) Amma Power Tool Co., Ltd.
Foot of McLean Drive, Vancouver, B. C.

ONLY THE DRIVE-IT "300" GIVES YOU ALL THESE FEATURES

- ☑ Controlled power with one power charge
- ☑ Positive, 3-way safety
- ☑ Uses flangeless drive-pins
- ☑ Permanent, adjustable safety pad
- ☑ Semi-silent operation
- ☑ Automatic extension barrel



DRIVE-IT "238"

Get the full story on DRIVE-IT

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CREATIVENESS
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CASTELL
world's finest drawing pencil

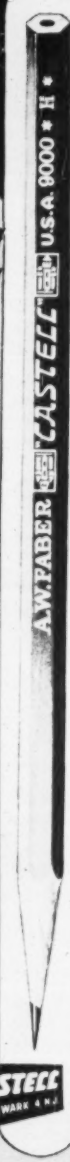
with the Genuine
IMPORTED
CASTELL
lead

CASTELL is first choice among the Masters in architecture, engineering, designing and drafting. So smooth, so free-flowing, it's an inspiration to genius.

CASTELL's 18 degrees are so uniformly exact, you can start a drawing one year and return to it the next—and be sure of identical, undeviating tone.

Naturally, CASTELL costs a few pennies more—but it lasts so much longer than ordinary pencils that it's more economical in the long run.

Follow the example of the Masters. Insist on CASTELL—and don't allow yourself to be talked into a substitute.



A.W. FABER-CASTELL
PENCIL COMPANY INC. NEWARK 4, N.J.

EDUCATION and RESEARCH

MAIN READING ROOM on the second floor of the new Charles Hayden Memorial Library, Massachusetts Institute of Technology, Cambridge, Mass., is the focal point of the library system of the institute whose activities in the humanities are expanding. The library also contains a large collection of books on engineering and science. It was made possible through a gift of $2,200,000 from the Charles Hayden Foundation.

Metropolitan area growth patterns to be studied

A detailed study of the growth patterns of metropolitan areas will be undertaken by the Scripps Foundation, Miami University, Oxford, Ohio, under the sponsorship of the Housing and Home Finance Agency.

The studies will be made under a research agreement between the foundation and the new Division of Housing Research of the HHFA, which is launching the comprehensive research program created in the Housing Act of 1949.

Commenting on the metropolitan area study, Richard U. Ratcliff, Director of Housing Research, said that lack of adequate knowledge of the patterns of urban growth has handicapped the development of sound city planning and the building of residential areas that are properly related to centers of employment, lines of transportation, and commercial and recreational facilities.

The Scripps Foundation studies, which will use census and other data, will be made of every metropolitan area. The results are expected to be of practical value to all segments of the home-building industry, to government housing agencies, to the public generally, and to any group or individual needing a direct local application.

Items to be considered in the study include population classifications by age, sex, nativity, education, employment status, major occupational group, major industrial group, wage and salary income, marital and family status, ...

Study sand deposits in Santa Barbara harbor

Engineers from the University of California have begun their study of baffling wave action and sand deposition in Santa Barbara harbor, called "one of the most consistently calm shorelines of the entire California coast."

Under the direction of UC oceanographic engineer Willard Bascom, three survey crew men have installed a Dynes recorder and a speedomax as the first step in the project to discover the causes of heavy shore movement and harbor filling.

It has been estimated that an average 800 cu yd of sand are being deposited in the harbor each day, necessitating periodic dredging operations costing the city, county and federal governments $60,000 a year. Since the harbor's breakwater was completed in 1928, millions of dollars in valuable beach have been washed seaward.

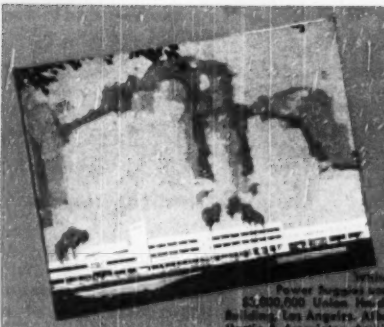
While the average amount of sand deposits per day has been known, the effect of climatic and wave conditions on the volume of this movement has never been determined.

The university engineers will make regular surveys of the harbor floor, charting each survey on profile maps and checking wave and wind instruments whenever radical changes in sand deposition occur.

The speedomax will record the height and interval of waves by means of a cable extending 100 yards into the ocean outside the breakwater. Electrical impulses from the cable are

(Continued on page 76)

terrific man-hour savers



Whiteman Power Buggies used on $3,800,000 Union Hardware Building, Los Angeles. Albert C. Martin & Associates, Architects. Baruch Corp., Gen. Contractors.

BARUCH CORPORATION
5655 WILSHIRE BOULEVARD
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Telephone York 8201

Whiteman Manufacturing Co.
Gentlemen:

You will be interested in knowing that we have found Whiteman Power Buggies of great value in concrete pouring operations.

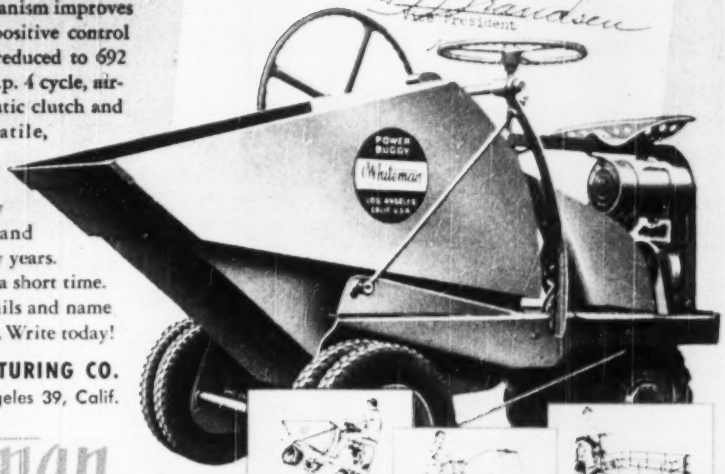
We have used them in upper floor pours, on flat pans, joist pans, penthouse, roof and fire walls, ground slabs, and for general utility hauling. We have been very well pleased with this equipment.

Yours very truly,
BARUCH CORPORATION
By [signature]
Vice President

NEW! IMPROVED! 1950 MODEL

The new 1950 Whiteman Power Buggy does the work of *six* men with wheelbarrows. It hauls concrete, sand, brick, mortar... anything you can load in or on it... over soft earth, up 25% grades, to upper floors, over light scaffolds, through doorways. Turns in its own length. Capacity enlarged to 13 cu. ft. or 2,000 lbs. Speed increased to 16 mph. New dumping mechanism improves leverage, gives operator positive control of the dump. Weight is reduced to 692 pounds. Powered by 7.5 h.p. 4 cycle, air-cooled engine, has automatic clutch and speed changer. The versatile, tough, dependable Whiteman Power Buggy has thoroughly proved itself with large and small contractors for many years. Priced to pay for itself in a short time. Send coupon now for details and name of your nearby distributor. Write today!

WHITEMAN MANUFACTURING CO.
3249 Casitas Ave., Los Angeles 39, Calif.



Climbs 25% grades with ease.

New "in gear" mechanism gives sure control of dump & return.

Also available with dumping stake type body.

Whiteman

Power Buggy

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WHITEMAN ROOFING MACHINE

Vibrates, puddles and screeds in one operation... for thorough compaction. Spans screeds up to 20 ft. on centers. Available in two sizes.

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- With "snap-on" float trowels, brings up moisture and cements slab. Final finishes with finish trowels. Pitch adjustable while machine in motion.
- Gas or electric models in two sizes.

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Company _____
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HIGHWAY JOBS

Accurate Depth Control*—plus CLEVELANDS ruggedness, dependability and speed—makes CLEVELAND TRENCHERS the machines that really pay out on the specialized highway jobs as well as on the routine trenching applications.

*Note CLEVELANDS patented Dual-Pivoted Grade Indicator, showing above the Trencher in the picture.

See your local distributor for details & specifications.

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CLEVELANDS
MORE TRENCH in MORE PLACES at LESS COST

charted on a graph, thus establishing the wave pattern at any hour of the day.

The wave chart will be correlated with the Dynes wind measurement—giving engineers a means of establishing effects of these conditions on the harbor floor.

Local government courses

Courses in municipal government will be offered at Stevens Institute of Technology, beginning with the fall semester. Originated in the graduate school, the courses will be part of a four-point program to provide in-service training for municipal government officials; instrument the Stevens Bureau of Municipal Research to provide expert guidance for municipal officials; give courses in local government to both graduate and undergraduate students; and eventually provide a graduate program in local government leading to a master's degree.

The program has been set up after an intensive survey made by Prof. Arthur Lesser, Jr., head of the Department of Management, to learn what colleges and universities are doing in the field of local government. Professor Lesser found that many universities, both public and private, especially in the Middle West and East, are making great strides in training local government officials.

It is expected that, as the four-point program gets under way, Stevens will become a service center for municipalities, helping to solve problems for them, carrying out research projects and making efficiency surveys, and offering guidance on long range problems and objectives.

Faculty News

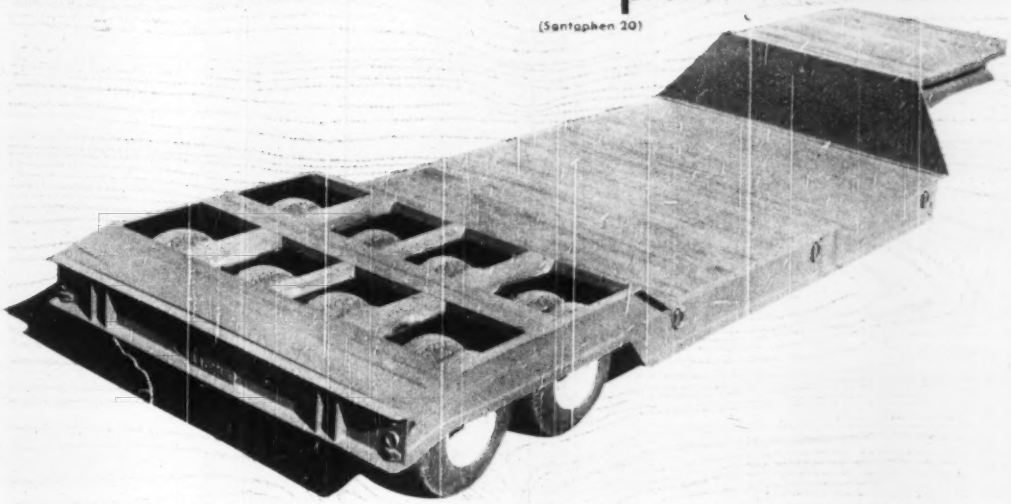
Charles B. Stanton, professor of civil engineering and assistant to the president of Carnegie Institute of Technology, is retiring after 39 years on the staff. Harold A. Thomas, another professor of civil engineering, and an authority on hydraulics, is also retiring after 27 years.

Prof. J. O. Muir has been made head of the department of civil engineering at the University of British Columbia. He is a graduate of the University of Manitoba, and from 1931 to 1935 he was a structural designer for Winnipeg. H. J. MacLeod is the new dean of the faculty of applied science.

Dean Paul Cloke of the University of Maine's College of Technology, will retire July 1 to be succeeded by Ashley S. Campbell. Dean Cloke has headed the college for 24 years.

Pachyderm of trailers protected by Monsanto PENTA CHLOROPHENOL preservative

(Santophen 20)



MONSANTO PENTA protects the decking in this mammoth, 54-ton La Crosse Trailer. The deck is made of 2½ inch oak.

A formulation of Monsanto Penta adds to the life of the decking of the 54-ton La Crosse Trailer by increasing its ability to withstand wood rot and by guarding it against damage by insects and fungi.

Monsanto Penta can be formulated to give *clean* treatment, even making treated wood paintable. Penta stays in the wood through blistering sun. And, since penta is virtually insoluble in water, the treatment withstands exposure to rain and snow. Monsanto Penta is positive protection against termites and other wood-boring insects . . . against fungi which cause wood to rot.

Penta, which may be applied by pressure, dip or brush methods, is used to protect all types of wooden construction, from bridge timbers to fence posts . . . from barn sills to millwork for fine homes.

If you wish further information about protecting wood with Monsanto Penta, mail the coupon or contact the nearest Monsanto Sales Office. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1759-F South Second Street, St. Louis 4, Missouri.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto Canada Ltd., Montreal.

MONSANTO CHEMICALS — PLASTICS

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
1759-F South Second Street, St. Louis 4, Missouri
Please send information on the use of Monsanto Penta to protect wood used for

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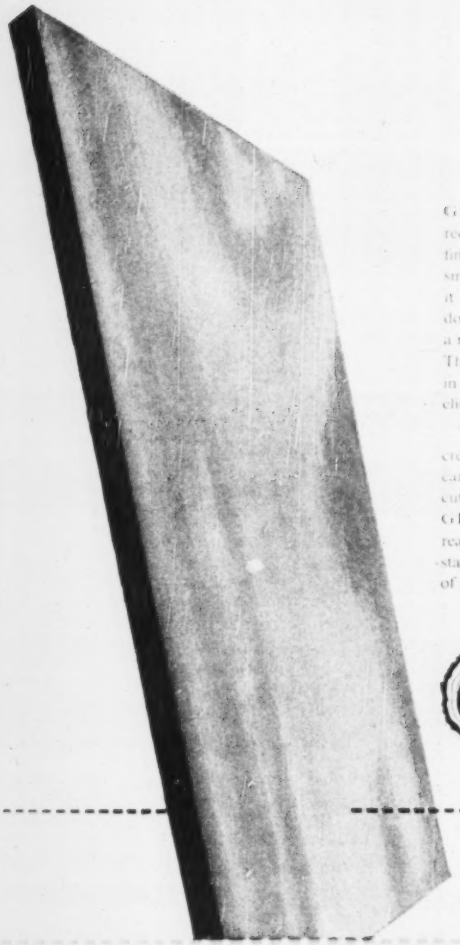
Company _____
Street _____
City _____ Zone _____ State _____

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Case Study

AT WILLCOX-BEIN-FISH-McHUGH PROVES THE ECONOMY OF GPX PLASTIC-FACED PLYWOOD



GPX provides the ideal material for reducing the cost of producing highly finished concrete surfaces. Its inherently smooth, armor-hard plastic surface gives it unbelievable wearing qualities. Work done with GPX Concrete Forms requires a minimum of "grinding and pointing." The resultant surface is so smooth that, in the case of ceilings, plastering can be eliminated entirely.

The number of re-uses of GPX Concrete Forms is determined solely by the care with which it is handled and the cutting necessary for pipes and outlets. GPX Concrete Forms, if handled with reasonable care under special circumstances, can be used literally hundreds of times.

GPX is an extremely high-grade exterior Douglas Fir Plywood with a superior plastic overlay applied under heat and pressure at the time the plywood is being bonded. RESULT: the plastic flows, condenses and sets forming a hard plastic surface that becomes *a part of the plywood itself*—not merely an added surface layer.

Investigate GPX today. It is a quality product of Georgia-Pacific Plywood & Lumber Co. with practically unlimited application for building, in industry and on the farm. For further information, write on your firm letterhead or fill in and mail the coupon appearing at the bottom of the page.

GP

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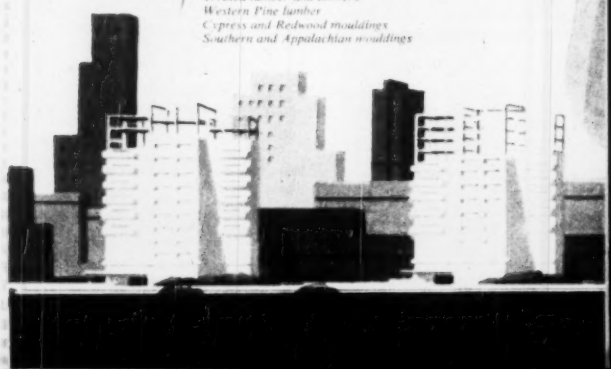
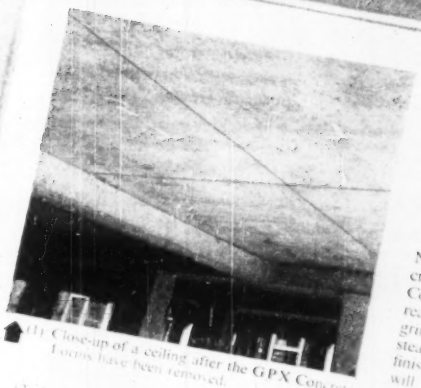
Long leaf and short leaf Pine lumber and timbers
Treated lumber and timbers
Western Pine lumber
Cypress and Redwood mouldings
Southern and Appalachian mouldings





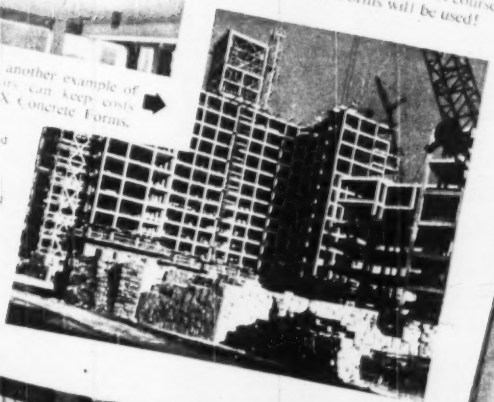
(1) Close-up of a ceiling after the GPX Concrete Forms have been removed.

(2) Smooth finish of completed ceiling after the fins shown above have been ground off, and smooth concrete surface has been painted.

One of the most important recent developments in the construction industry has been the acceptance and extensive use of Georgia-Pacific's plastic-faced plywood, GPX, for Concrete Forms. Their economy in use, handling and maintenance is, today, serving to keep costs down on construction projects everywhere.

Willcox-Bein-Fish-McHugh, alert New York contractors, use GPX Concrete Forms exclusively for ceilings. Ceilings poured into GPX Forms are ready for painting after only a minor grinding and smoothing operation instead of the customary 3 coats of plaster finish. In addition, one GPX Form will maintain its smooth surface at least three times as long as forms made of ordinary plywood. WILLCOX-BEIN-FISH-McHUGH REPORT THAT ON LESTER PATTERSON HOUSES TO GET A COMPARABLE CEILING WITH OLD TYPES OF FORMS, WOULD HAVE COST $50,000 TO $60,000 MORE THAN IT DID WITH GPX CONCRETE FORMS.

Willcox-Bein-Fish-McHugh first used GPX Concrete Forms when working on the construction of Manhattan's well-known Jacob Riis Houses. Since that time, these progressive builders have used GPX on the Gowanus Houses, Section One of the Governeur Houses, Section One of the Alfred E. Smith Houses, Lester Patterson Houses, and Queensview Houses.* About to be started by this firm is Section Two of Astoria Houses. Of course, GPX Concrete Forms will be used!



Lester Patterson Houses, another example of how progressive contractors can keep costs down by the use of GPX Concrete Forms.

*The architects on the projects listed above were:

Jacob Riis—I. T. Steinman
Gowanus—Clarence Stein
Governeur—Willcox & Colgrove
Alfred E. Smith—Cantilo, Kahle, Jacobs and Hastings
Queensview—Alexander Bonnet and Alfred E. Smith—Eggers & Higgins
Lester Patterson—I. T. Steinman
Astoria—I. T. Steinman
Unit 1—Harrison & Abramovitz
Unit 2—Harrison & Abramovitz
Queensview—George Bruce
Bernard Gaumer

1 CARRIES HEAVIER LOADS FASTER AND MORE PROFITABLY ON LARGER TIRES
2 DETACHES QUICKLY FOR FAST, EASY FRONT LOADING
3 STOOPS TO CLEAR LOW OVERHEAD OBSTRUCTIONS
4 RAISES ITS DECK TO CLEAR HIGH BANKED CROSSINGS

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DETACHABLE GOOSENECK

(Patent Pending)

A trailer equipped with this new type gooseneck will handle more of the difficult loads, easier, faster and more profitably.

Due to unusual versatility it will haul a wide variety of loads and make unnecessary the investment in varied equipment that would otherwise be necessary.

The larger tires are adequate for heavier than usual loads but the lighter hauls are profitable, too, because of the Rogers "easy roll" oscillating rear end units.

This most unusual gooseneck with its many advantages available on most Rogers Trailers and adaptable to many trailers of other makes.

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135 Orchard St.
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ELECTIONS AND ACTIVITIES

The Private Practice Group of the Ohio Society of Professional Engineers has elected L. B. Henry, Toledo, chairman, Paul Dumond, Lancaster, John M. Schweiger, Dayton, Arthur E. Rowe, Cleveland, and Carlton S. Finkbeiner, Toledo, as vice-chairman. Myron F. Jones, Columbus, who died in June, had been named secretary-treasurer.

The Municipal Group of the Ohio Society of Professional Engineers elected William H. Brabson, Dayton, as chairman, and Edwin L. Pollard, Dayton, as secretary-treasurer. The four vice-chairmen were to be chosen later.

The Public Utilities Group of the Ohio Society of Professional Engineers re-elected Wayne R. Deimel, Columbus, as chairman, and E. T. Hunziker, Columbus, as secretary-treasurer.

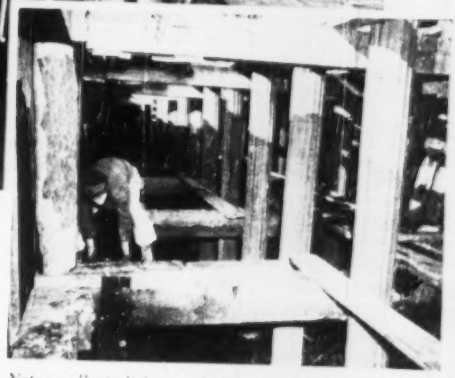
At the recent Western Chapters Conference of the Associated General Contractors held in Reno, Nev., officers elected included: Chairman, Wm. C. Tait, W. C. Tait Co., San Francisco; first vice-chairman, A. S. Horner, A. S. Horner Construction Co., Denver, Colo.; second vice-chairman, John H. Sellen, John H. Sellen Construction Co., Seattle, Wash.; and secretary, Frank Corker, manager, Central California Chapter, AGC. This group includes representatives on a voluntary basis from AGC chapters in the eleven western states. Its purpose is to afford a forum for exchange of ideas on labor relations and other matters by contractors in the Pacific Coast area. Next meeting is scheduled for San Francisco Oct. 30.

A Construction Council is being organized at Waco, Tex. to represent the building industry in all public civic movements and matters pertaining to Waco's development. The council will also publicize the fact that the building industry in Waco can perform any type of construction, using the most up-to-date methods, materials and designs. The council is a non-profit organization. J. H. Elrod, engineer, is head of the executive committee; Ed Johnson, general

(Continued on page 82)

Fast simplified driving of 70-foot Monotube Piles for pier under Boston side of Eliot Bridge.

No danger to this cofferdam



Note excellent alignment of Monotube piles. Extremely close tolerances alongside bracing and sheet piling made it imperative that there be no "walking" or lateral movement under hard driving.

PICTURED here is another difficult bridge-building job where Monotube Piles helped by greatly simplifying the problems of water work. The job is the Eliot Bridge, Cambridge, Massachusetts. It is to be a beautiful 5-span bridge, 418 feet in over-all length, 85 feet wide. It will have two 30-foot roadways, separated by a 4-foot median strip, with 8-foot sidewalks.

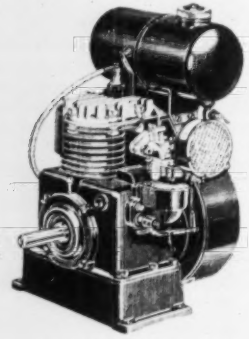
Following construction of the cofferdams, the 70-ft. Monotube Steel Piles were driven safely, swiftly and smoothly—78 for each pier. Neither the hazards of water, nor the blue clay—sand—gravel river bed, were problems for the Monotubes . . . as evidenced by easy, top-to-bottom inspection after driving.

You can't afford to disturb the bracing or the alignment on a cofferdam as large as this. The *light*, sturdy Monotubes were safely placed in templates nailed to the cofferdam bracing. They were then driven to their high bearing loads without any fear of "walking" which might easily result in excessive deflection of the bracing, or even the cofferdam itself.

Monotube piles have extra advantages that can help reduce foundation costs while simplifying sound construction from start to finish. Monotubes are available in lengths, gauges, sizes and tapers to meet varying soil conditions. For complete information, write The Union Metal Manufacturing Company, Canton 5, Ohio.

UNION METAL

Monotube Foundation Piles



Model K7-1, 3½ H.P. 4-cycle, single cylinder, air cooled. Length 13", width 13", height 12". Weight 48 lbs.

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Rollers
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Kohler Engines are designed, engineered and built to give the same dependable, economical service that has won world-wide acceptance for Kohler Electric Plants in construction and other industries. Made in several sizes, they are suited to a wide range of uses. Kohler engineers will gladly assist in working out applications for your particular requirements. Write for information. Dept. 23-W, Kohler Co., Kohler, Wisconsin. Established 1873.

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contractor, is head of the organization committee; Roy McClellan, general contractor, is head of the budget committee; and Lee Fulgham, subcontractor, is head of the membership committee. Brooks W. Pearson is executive secretary.

Howard C. Carpenter has been elected president of the Chemung County Chapter of the New York Good Roads Association at Horseheads. Other officers: Vice presidents, R. C. S. Potter and Lyman Gridley; secretary, Charles H. Sickles; and treasurer, Russell F. Cee.

Walter B. Mills of Gadsden, Ala., was elected president of Southeastern Regional Council of the National Association of Housing Officials. Don Barbour of Mobile was named to the executive committee.

General contractors of North Dakota are now affiliated with the Associated General Contractors of America, Inc. Joseph M. Powers of Fargo is president. Other officers: Orval Hgaen, secretary-treasurer; directors, Paul Rod, Oliver Stoutland, Walter Johnson, L. M. Swingen, Joseph R. Mackley, Leif Mattson, L. E. Ofheim, Ed Moline and John Larson.

An engineering committee headed by F. J. Blythe of Blythe Brothers Co. of Charlotte, has been named to serve the Governor's Advisory Committee on Highway Safety which is seeking ways of cutting down the increasing number of highway accidents in North Carolina. Other members are: Garland E. Bobbitt and Ralph E. Dalton of Raleigh, H. M. Eastwood of Jacksonville, W. H. Hall of Durham, A. C. Lawrence of Apex, Frank Miller and George D. Thompson of Greensboro, J. N. Pease of Charlotte, P. N. Taylor of White Plains, J. C. Walker of Asheville and Roy Williamson of Rocky Mount. Roy S. Braden, city manager of Raleigh, has been named chairman of a committee studying off-street parking, and other members of the committee include City Managers Robert W. Flack of Durham and Henry A. Yancey of Charlotte.

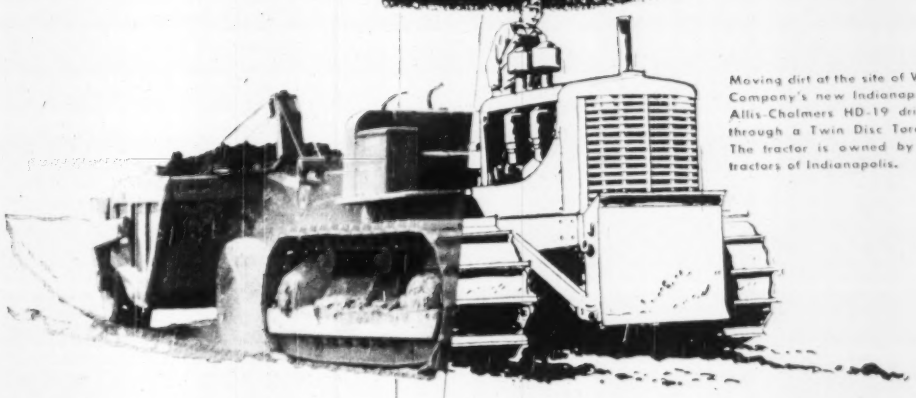
The Wheeling Chapter, West Virginia Society of Professional Engineers, has elected Creed Malone, Jr., as president; W. L. Kaiser, vice president; Robert S. Carnahan, secretary-treasurer; Robert W. MacDonald and George W. Zimmer, Jr., directors.

At a recent meeting of the American Institute of Steel Construction, L. J. Bodewes, manager of the struc-

(Continued on page 84)

FREE YOUR DRIVER AND

MOVE *more* DIRT



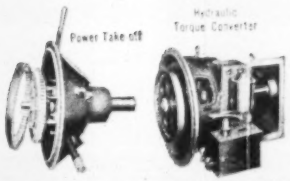
Moving dirt at the site of Western Electric Company's new Indianapolis plant, this Allis-Chalmers HD-19 drives its power through a Twin Disc Torque Converter. The tractor is owned by General Contractors of Indianapolis.

THE *freedom* it gives your driver is only one of the striking advantages of a tractor in which power is transmitted through a Twin Disc Hydraulic Torque Converter . . . *freedom* from constant wrestling with gear shift levers, from clutching and de-clutching . . . *freedom* to pay more attention to the work of his machine, which pays off in more dirt moved.

Your driver can give his full attention to the job because a Twin Disc Torque Converter (Lysholm-Smith type) *automatically and instantly* selects exactly the right power for any given pull . . : provides an infinite number of power ratios . . : *actually multiplies torque of the engine up to five times.*

Besides sparing your driver's attention from operations that can be better performed automatically, the Twin Disc Converter also spares your tractor and engine from costly lay-up time . . . because the torque converter provides a flexible, *fluid link* between the engine and tracks to absorb ruinous starting jerks and bumpy ground jolts.

For more information on the Twin Disc Torque Converter, write for Bulletin 135-C. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



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If you're looking for a cement placement hose with the *right* combination of strength, light weight, and flexibility — try Hewitt-Robins!

TOUGH! Carcass wall is extra-strong, reinforced with multiple plies of high tensile duck bonded with pure gum rubber. That means stretch-resistance that keeps the hose from expanding under pressure. Inner tube is compounded of gum rubber—*a full ¼ inch thick*—especially treated to withstand abrasive action of sand and cement mixtures.

LIGHT! Exceptional strength of the duck plies eliminates need for a rubber cover. That means less weight, less worker fatigue.

FLEXIBLE! High quality materials and built-in toughness give this hose less bulk, more flexibility. That means real handling ease.

YES, HEWITT-ROBINS gives you the *right* combination in cement placement hose to meet even the heaviest service requirements in mines, tunnels, viaducts, bridges, wherever cement reinforcements are used.

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Monarch Wrapped Duck

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tural fabricating department of Joseph T. Ryerson & Son, Inc., Chicago, Ill., was elected a director.

The Industry Group of the Ohio Society of Professional Engineers has elected Arthur B. Heiberg, Akron, chairman; T. F. Hindman, Cleveland; George Spengler, Cincinnati; James D. Brown, Toledo, and Benjamin Eisner, Columbus, as vice-chairman, with Otto E. Sords, Akron, as secretary-treasurer.

R. H. Pickell of Bristol, Tenn.-Va., was elected chairman of the Virginia-Carolinas Fabricators Association at a two-day conference held at Asheville recently in connection with meetings of the Southern Structural Steel Board of Trade and the American Institute of Steel Construction. Other officers: Thomas B. McBrayer of Greenville, S. C., vice-chairman, and Earl Anderson, of Charlotte, N. C., secretary-treasurer.

Highway Group of the Ohio Society of Professional Engineers has elected Robert Fisher, Eaton, chairman; Hal Kramer, California; Ross Schultz, Toledo; Walter Moulton, Akron, and Ferd Robb, Mt. Vernon, vice-chairmen, with Joseph Unger, Dayton, as secretary-treasurer.

MAJOR MEETINGS

Photogrammetry Seminar, University of Denver, Denver, Colo., Aug. 7-11.

Maine Water Utilities Association, summer meeting, Mt. Desert Island, Me., Aug. 9.

ASCE, North Carolina section, joint meeting with N. C. Society of Engineers, Mt. Mitchell, Burnsville, N. C., Aug. 11-13.

Pennsylvania Water Works Operators' Association, spring conference, Nittany Lion Inn, State College, Pa., Aug. 14-16.

Pennsylvania Sewage & Industrial Wastes Association, Spring Lake, Lake Ariel, Pa., Aug. 20-22.

N. Y. section AWWA, fall meeting, Seneca Hotel, Seneca Falls, Lake Ontario Beach, Aug. 21-23.

W. Va. section AWWA, annual meeting, Pritchard Hotel, Huntington, W. Va., Sept. 12-13.

American Railway Bridge and Building Association, annual convention, Hotel Sherman, Chicago, Ill., Sept. 18-21.

New England Water Works Association, Poland Springs, Me., Sept. 19-21.

N. Y. Metropolitan section, Institute of Traffic Engineers, Columbia University, Low Memorial Library, N. Y. City, Sept. 24-27.

American Institute of Park Executives, annual conference, Baker Hotel, Dallas, Tex., Sept. 25-27.

Pennsylvania Water Works Association, Claridge Hotel, Atlantic City, N. J., Sept. 26-28.

Rocky Mountain Sewage Works Association, La Fonda Hotel, Santa Fe, N. Mex., Sept. 27-29.

● The complete cylinder assembly is identical for *all* P&H Diesels — 1, 2, 3, 4 and 6 cylinder models. Replacements can be made in the field — from one engine to another — saving hours — even days on the job. Another good reason for standardizing on P&H Diesels. For literature, write Diesel Division, Harnischfeger Corporation, Port Washington, Wisconsin.

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OBITUARY

Carlo P. Christensen, 65, director of the Hoover Dam project of the Bureau of Reclamation, died June 15 at Boulder City, Nev. He joined the project in 1934 as assistant engineer, and in 1940 went to Grand Coulee Dam for other engineering work. In 1944 he returned to the Hoover project as director. Before his work with the Bureau of Reclamation, he had been with the Westinghouse Electric Corp., Pittsburgh, Pa.; with Southern California Edison Co., Los Angeles. He also served as test engineer for the Metropolitan Water District in Los Angeles.

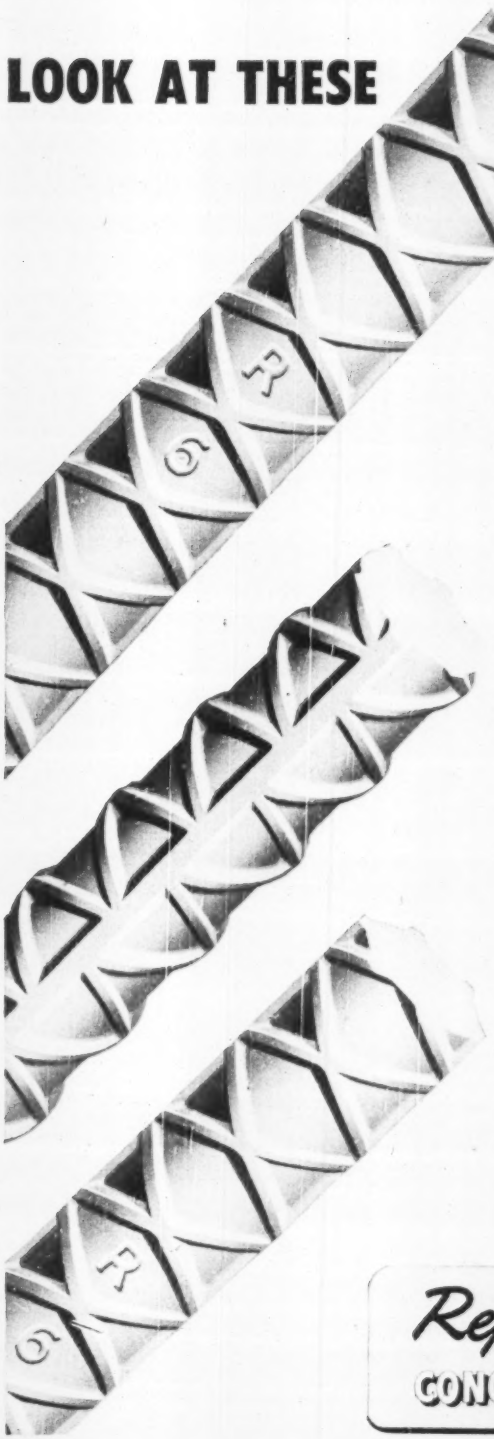
C. Wesley Taylor, 69, Los Angeles contractor, died June 15. He lived in Los Angeles for 48 years, and was the builder of many of the schools in the city.

Charles I. Day, 69, civil engineer and prominent industrialist of Troy, N. Y., died June 22. He was president of W. & L. E. Gurley. He was graduated from the University of Maine with an engineering degree in 1904 and received his master's degree in engineering from Cornell in 1905. He became chief engineer of the Florida East Coast Hotel Co. and later was vice-president and general manager of the Southern Utilities Corp. of Jacksonville, Fla. He moved to Troy in 1919 as general manager of W. & L. E. Gurley, the instrument firm. Mr. Day was a member of the American Society of Civil Engineers and the Engineer's Club of New York City. He was active in civic work and once served as president of Troy's Chamber of Commerce.

Rev. George Innocent Smith, O.P., 55, professor of engineering at the University of Notre Dame, was killed June 20 in a motorcycle accident near Kenton, Ohio.

Antonio Thomas Canozza, 75, who was often referred to as the dean of contractors and construction engineers in Maryland, died on June 20 at his home in Catonsville, Md. He helped establish the firm of Fisher and Canozza which was formed about 1898. The firm specialized in railroad construction until 1907. The firm then went into sewer and building construction and did a major portion of the Fallsway project in Baltimore, Md. The company also built the Hopkins Apartments and the Old Town National Bank Building in Baltimore, and installed the storm sewer system in Brooklyn, Md.

LOOK AT THESE DEFORMATIONS



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. . . they assure a better bond in concrete

That's because they were designed to exceed ASTM Specification A-305-49—"Minimum Requirements for the Deformations of Deformed Steel Bars for Concrete Reinforcement."

This specification—adopted by ASTM in June, 1949—is the first standard specification to define the surface deformations on concrete reinforcing bars. It requires that the lugs or deformations be much higher and more closely spaced than heretofore, without change in standard foot weights.

The results: Greatly improved bonding properties and reinforcement anchorage—possible savings in steel, bending cost and installation.

Republic's Diamond Design Concrete Reinforcing Bars are rolled only from new billet steel—at Cleveland, Buffalo, South Chicago and Gadsden. Check the table below for foot weights and new size designations—then write us for further information.

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Export Department: Chrysler Building, New York 17, N. Y.

Size Number	Cross Sectional Area, sq. in.	Nominal Diameter, in.	Foot Weight, lbs.
3	0.11	0.375	.376
4	0.20	0.500	.668
5	0.31	0.625	1.043
6	0.44	0.750	1.502
7	0.60	0.875	2.044
8	0.79	1.000	2.670
9	1.00	1.128	3.400
10	1.27	1.270	4.303
11	1.56	1.410	5.313

REPUBLIC STEEL

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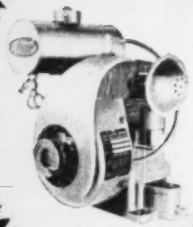
CONCRETE REINFORCING BARS

choose



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• Insist on Lauson — the engine that's first in quality! Here are just a few of the superior construction features which make Lauson the Long-Life engine: Connecting rods have replaceable crank-pin bearing liners.

• Precision ball bearings on both ends of crankshaft.

• Fly-ball governor running in oil.

• Automotive-type float feed carburetor.

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UNIT PRICES BID BY CONTRACTORS

Seawall, St. Thomas, Virgin Islands

American contractors from seven states and two Puerto Rico contractors entered the 5 bids, May 17, on the $894,388 waterfront improvement at Charlotte Amalie, St. Thomas, Virgin Islands. The letting was held by Community Facilities Service, General Services Administration, Washington, D. C. Plans were also available at District offices at St. Thomas and at San Juan, Puerto Rico. R. L. Kenan & Associates, Montgomery, Ala., is consulting engineer.

Under the reorganization plan recently enacted, public works in Virgin Islands has since been transferred from GSA to the Division of Territories and Island Possessions, Department of Interior. This contract will be carried out under direction of H. A. Bretlinger, Division of Territories and Island Possessions.

All materials and labor are to be furnished by the contractor. Completion time is 300 calendar days. Minimum wage rates are: for skilled labor $0.65 per hour, semi-skilled, $0.50, common labor $0.40.

The low bid is less than 3% under the second low and 49% under the high bid.

Bidders include:

1 Hicks, H. Pyson, San Juan, P. R. (Contr.)	$893,388
2 Caribbean Enterprises Corp., Condstore, San Juan, P. R.	919,925
3 American Caribbean Contractors, Inc., Des Moines, Ia.	1,289,992
4 South Atlantic Constr. Co., Miami, Fla.	1,330,953
5 Merritt-Chapman & Scott Corp., New York and Ely the Bros. Co., Charlotte, N. C.	1,382,401
6 Lane Engineering Corp., Mobile, Ala.	1,397,923
7 W. Horace Williams Co., New Orleans, La.	1,419,564
8 Sollitt Overseas Constr. Co., and George Sollitt Constr. Co., Chicago, Ill.	1,746,955

Using alternate 1, anchored concrete sheet piling seawall, only 4 bids:

1 $928,941	3 $1,410,906
2 909,791	4 1,912,633

Items	Quantity	Unit Prices 1¢	2
Rock till, private	cy	3,070	$5.50	$6.00
Large rock at face of rock fill	cy	500	7.50	10.00
Grtd riprap, 18" thick	sy	1,250	9.00	11.00
Grtd riprap, 32" thick	sy	250	15.00	19.20
Type 1 anchorage	ea	2	200.00	225.00
Type 2A anchorage	ea	182	110.00	116.00
Type 2B anchorage	ea	2	110.00	121.00
Tie rod	ea	321	82.50	96.00
Anchored sheet piling wall	lf	1,065	91.50	97.50
All timber sheet piling wall	lf	1,065	98.00	102.00
Seawall openings:				
10" pipe	ea	5	116.50	165.00
18" pipe	ea	4	135.50	175.00
24" pipe	ea	4	145.00	175.00
30" pipe	ea	1	200.00	210.00
2'-0" x 2'-6" box culvert	ea	1	32.00	132.00
2'-0" x 2'-9" box culvert	ea	1	62.50	126.00
3'-0" x 2'-6" box culvert	ea	2	73.00	108.00
24" slope inlet pipe	ea	2	116.00	143.00
Remove exist. seawall	cy	3	5.00	5.00
Concrete curb and gutter	lf	124	26.00	25.00
Sea wall D&F	cy	230.000	0.61	0.55
Pipe, 15"	lf	2,900	4.65	2.90
Pipe, 18"	lf	500	5.00	4.60
Pipe, 24"	lf	1,700	7.90	5.20
Pipe, 30"	lf	200	10.90	7.00
Box culv., 3'-0" x 2'-6"	lf	325	19.25	32.00
Box culv., 3'-0" x 2'-6"	lf	325	25.50	38.00
Box culv., 3'-0" x 2'-6"	lf	321	28.60	45.00
Outlet, 15" pipe, rfs	ea	3	35.00	65.00
Outlet, 18" pipe, rfs	ea	1	45.00	100.00
Outlet, 24" pipe, rfs	ea	1	70.00	100.00
Outlet, 30" pipe, rfs	ea	1	90.00	200.00
Rubble masonry	cy	1,150	15.00	40.00
Mh for st sew	ea	4	171.00	200.00
Mh for san sew by-pass	ea	4	171.00	200.00
Mh for st sew at pump sta no. 3	ls		303.00	150.00
Catch basins	ea	15	192.50	150.00
Street inlets	ea	2	166.00	170.00
Rdwy inlets incl outlet from gutter	ea	19	145.00	85.00
Remove exist mssy	cy	10	10.50	30.00
6" conc apron, incl grout	sy	9,000	4.30	5.65
Concrete curb and gutter (combined)		2,650	2.30	2.65
Anchored sheet piling pier, 14' section, complete including all items of every description				
rfs, rock till seawall, incl conc wall and grouted reinforcement, not incl pipe				

Repairs to tailrace, Seminoe Dam, Wyo.

Prices for repairs to the tailrace of Seminoe Dam and Power Plant, Kendrick Project, on the North Platte River, Wyoming, were received April 12 by the Bureau of Reclamation, Casper, from four bidders. All bids were above the engineer's estimated $179,585.

The job involves constructing a concrete gravity retaining wall on the left side of the tailrace, backfilling, reconstructing a portion of the access road, and removing materials from the tailrace channel. This work must be completed within 200 days.

Cement, pipe and fittings for hand rails with rivets, cap screws, flanges and other accessories will be furnished by the government. Wages to be paid are: skilled laborers, $1.45 per hour, mortar mixers, $1.70, cement finishers, $2.20, pipe fitters, $2.25, power equipment operators, $1.40-2.15, truck drivers, $1.674-1.924.

1 Shattuck and Purtell, Casper, Wyo.	$231,900
2 Northwestern Engineering Co., Dev. Co., Cody, Wyo.	313,905
3 Knisely Moore Co., Douglas, Wyo.	405,175
4 Lang Concrete Co., Inc., Billings, Mont.	431,170
Engineer's estimate	429,365

Items	Quantity	Unit Prices 1¢	2
Excavation:			
Gravity wall & cut-off	cy	1,250	$10.00	$15.00
Channel improv	cy	20,000	2.50	3.00
Bk fill, accepted	cy	15,100	1.00	2.00
Grass mat, 18 mix	sy	1,300	5.00	5.00
Drl holes for anchor & gr bars	lf	250	30.00	40.00
Conc, mass, cut-off & gravity wall	cy	560	35.00	30.00
Conc, gravity wall	cy	1,470	32.00	43.00
Reinf bars, CS, p	lb	39,000	.15	.15
6" mm std A pipe drains, CA, incl	lf	1,000	.20	1.00
24" riser in cut-off, std A	lf	22	6.00	5.50
Trash rack, fabricated	lb	3,000	.15	2.00
Steel pipe handrail	lf	1,000	.15	2.00
Remove pipe guardrail, A	each	10	3.00	1.00
Pipe railing	lf	1,000	3.00	4.00
Pipe railing, C, contract				

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Write today for the name and address of your nearest Alemite representative. Address your proposal to Alemite, Dept. G-70, 1850 Diversey Parkway, Chicago 14, Illinois.

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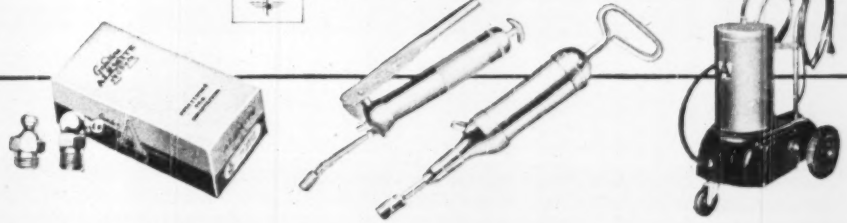
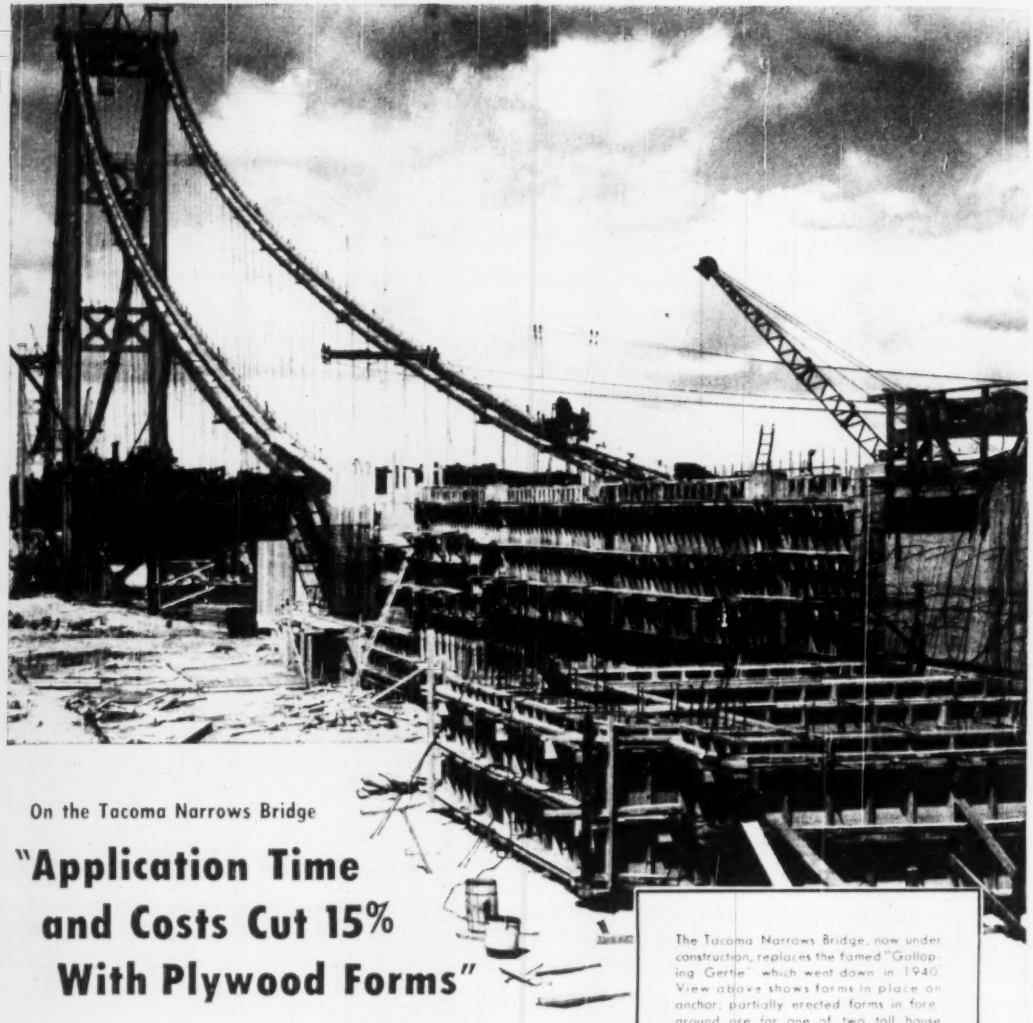




On the Tacoma Narrows Bridge

"Application Time and Costs Cut 15% With Plywood Forms"

"ONLY PLYWOOD could produce the specified smooth, blemish-free concrete surfaces and also permit simplified, built-up form construction which saved 15 per cent on time and labor costs," says Earl Starland, superintendent in charge of concrete work on the spectacular mile-long Tacoma Narrows Bridge.

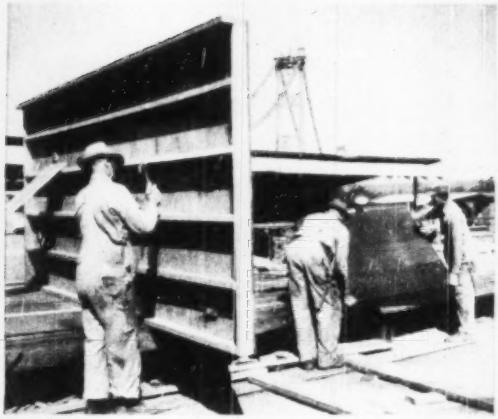
On the job, almost a third of a million feet of Douglas fir plywood is being used for form work on the reinforced concrete road slabs and all exposed concrete on approach structures, viaduct and bents. Reason? "Smooth, easily-finished concrete; speed through ease of handling and large panel sizes; overall economy."

These comments are just one more example of why plywood is preferred for all types of concrete form work. Plan now to put these advantages to work for you. Write for two free booklets described at right.

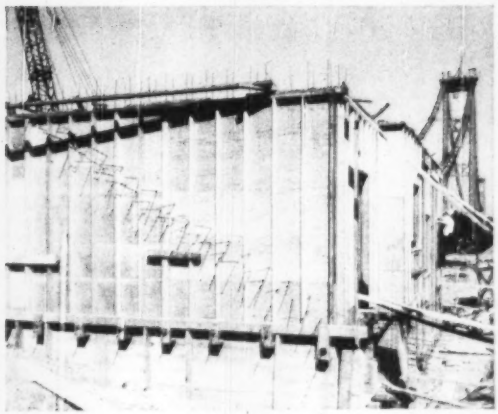
The Tacoma Narrows Bridge, now under construction, replaces the famed "Galloping Gertie" which went down in 1940. View above shows forms in place on anchor, partially erected forms in foreground are for one of two toll house structures. Total length of project 7,250'. The bridge itself 5,979'. Main span 2,800'. Constructed by Washington State Bridge Authority, Chas. E. Andrew, chairman and principal engineer. Dexter R. Smith, designing engineer. Concrete work, Woodworth and Co., Tacoma.

Douglas Fir Plywood

AMERICA'S



Form erection time was speeded by pre-building plywood form sections for anchors, approach structures and viaduct. Inner form faces were built in usual manner; steel reinforcing was then installed and built-up plywood forms were erected in position. For anchor, ¾" Exterior Concrete Form Douglas fir plywood was nailed across 2"x 6" studs, 16" on center, backed by double wales 24" to 30" on center. Due to decreased concrete pressure, wale spacing was increased toward the top.



Form construction on the approaches and toll houses is similar to that on anchors, except 2" x 4" studding is used. Toll houses are each about 30' x 20' and two and a half stories high. Concrete anchor weighs 22,000 tons, is 30' deep, 190' wide and 420' long.

Large, Light, Strong Real Wood Panels

For additional data on Douglas fir plywood for concrete form work, write Douglas Fir Plywood Association, Tacoma 2, Washington. Of particular interest are two booklets: "Concrete Forms of Douglas Fir Plywood" and "Handling PlyForm".

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For Smooth, Fin-Free Concrete Surfaces...

PLYFORM

Concrete Form Panels

Smooth, fin-free surfaces . . . ease of handling . . . strength, rigidity, tightness . . . superior nail holding qualities . . . cost-cutting re-use factors—these are primary advantages of PlyForm. Highly moisture-resistant glues used in PlyForm panels permit multiple re-use (as many as 10 to 15 are not unusual). For the greatest possible panel re-use, however, specify Exterior-type Concrete Form grade of Douglas fir plywood—bonded with completely waterproof phenolic resin adhesive. For special architectural concrete, requiring the finest possible finish, the architect or contractor may specify Exterior-type or Interior-type Douglas fir plywood in grades having "A" face veneer—or one of the new plastic-surfaced panels.

Yours for $1

New Keely PlyForm calculator gives construction data for plywood forms, based on hourly rate of pour. Complete with leaflet, "Design Assumptions for New Keely Calculator." Send coupon now!

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TACOMA 2, WASHINGTON (Good in USA only)

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Address.....

City.....Zone.....State.....

CONSTRUCTION REPORTS

Bids Asked—Low Bidders—Contracts Awarded

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.
ELSIE EAVES, Manager J. A. MAHONEY, Reports M. R. ROESSLER, Statistics

WATER SUPPLY

BIDS ASKED

Conn., Middletown (B.A. 7-11) City Water Dept., M.S. Hall, Engr., intake, tunnel, pumping station, filtration plant, 2 reservoirs, 2 mains, etc.; estimated cost $2,500,000; Bids to Engr., 155 Main St., Middletown, July 18.

CONTRACTS AWARDED

Fla., Sarasota City water softening plant addition, new water supply well, new elevated water storage tank, new transmission mains, etc. Main Bldg., Zone 2, $231,773 and $67,211 respectively. Bids for 6 awards to Layne-Florida, Inc., Tampa.

Ky., Morehead City water works, 3 MG reservoir, 2 water supply wells, 2 pumping stations, 2 mains, etc.; Bids to Engr., W. W. Orr, Lexington, $167,365; water supply line, $130,000.

$2,216,816

$79,812

CONTRACTS AWARDED

Arizona State Hy. Dept. Phoenix, 2 mi. grade & drain, 5 mi. W. Mesa, $68,003.

† Montana Missoula Co., Missoula, $448,632.

$155,900

$236,820

SEWERS, WASTE DISPOSAL

BIDS ASKED

Kan., Pratt (B.A. 7-25) City, sewage treatment plant, 2 lift stations, 2 mains, etc.; estimated cost $1,000,000; Bids to Engr., E. J. Bell, Jr., Pratt, July 31.

LOW BIDDERS

Conn., Mercer City, sewage treatment plant, 2 lift stations, 2 mains, etc.; Bids to Engr., Wm. Hall, Meriden, $160,252.

Tex., Odessa City, reported bids May 29, storm sewer, $136,947.

CONTRACTS AWARDED

Ill., Springfield (sanitary district), 2 mains, $59,941.

BRIDGES

LOW BIDDERS

California State, $502,373.

CONTRACTS AWARDED

Colo., Denver, $200,000.

STREETS AND ROADS

LOW BIDDERS

▲ Kentucky

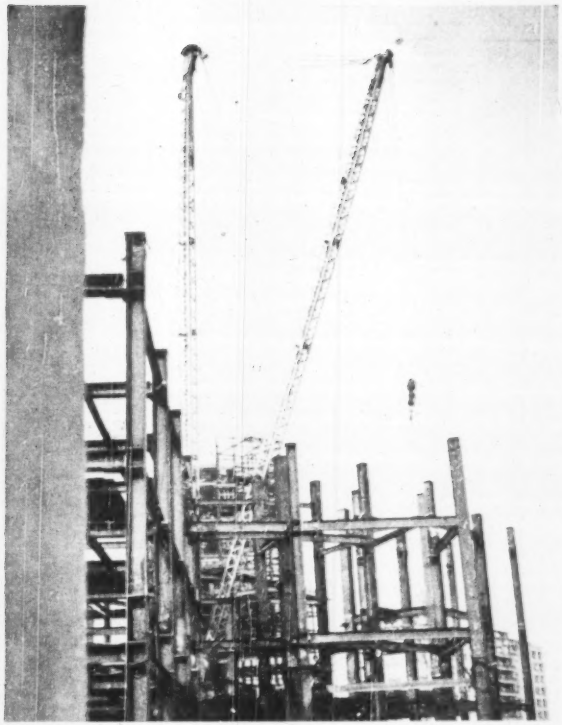
EARTHWORK, WATERWAYS

BIDS ASKED

† Illinois (B.A. 7-11) Div. of Waterways, Dept. Public Works & Buildings, Springfield, Ill., Mississippi River Levee Improvement, Section 1, Calhoun County, Levee Unit No. 1, 2 pumping plants, 2 sluiceways, 2 mains, etc.; estimated cost $1,500,000; Bids to Engr., Springfield, July 18.

LOW BIDDERS

† Missouri Kansas City, Missouri River Bridge, 3 E. 27th St., Kansas City, Mo., 1 pier, 2 abutments, 2 piers, 2 spans, 1 steel, 1 concrete, 1 steel & concrete, 1 steel & concrete, 1 steel &



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One big name

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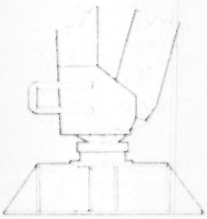
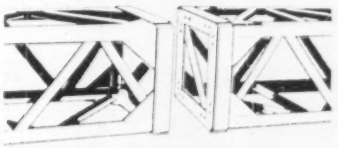
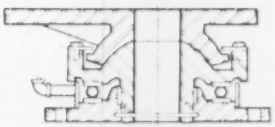
Wherever steel-frame buildings are built, American Designed Terry Derricks are far and away the favorites. There are many reasons—but this is the most important: Safety and efficiency in a derrick are created about 85% by its engineering, 15% by its fabrication. Here at American Hoist, we have studied derrick design for 69 years. We have made every size, every type of derrick—in large numbers. In Terry Derricks, as in the complete American line, this experience and resourcefulness and know-how have made the name American the *one big name*.



MAST LOCATED BEHIND CENTER OF ROTATION. With mast set behind the boom pivot, the boom of the American Terry Derrick can turn in a full circle and have equal lifting capacity over the front and rear.



BUTT TYPE SPLICE ELIMINATES 75% OF BOLTS. Because each member requires only 4 bolts instead of 16, mast sections are joined with 4/5 fewer bolts at every splice point.



BALL BEARING MAST BOTTOM ASSEMBLY. The mast rotates on a ball bearing. Other features of American Terry Derricks include [illegible] and an [illegible] boom.

American Hoist
& DERRICK COMPANY
St. Paul 1, Minnesota

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Company

Address

City Zone State

This is it!

THE AIR METER

you have been waiting for!

IMPROVED PRESSURE METHOD FOR TESTING AIR ENTRAINED CONCRETE

FEATURES OF THE

PRESS-UR-METER

- Precision built—accurate—fast
- Tests aggregate moisture & sp. gravities
- Not affected by changes in barometric pressure
- Exactly .250 Cu. Ft. capacity
- Light in weight
- Compact—built-in pump and instant release valve, automatically closed when not in use
- Quick and easily adjustable clamps
- Simple method provided for testing accuracy of the Meter
- Reasonably priced by standardized production methods
- Approved and in use by government agencies

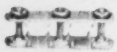
For complete information write to

Exclusive Sales Agents

CHARLES R. WATTS & CO.

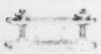
4121 6th Ave. N.W. Seattle 7, Wash.

KEEP YOUR CONVEYOR BELTS GOING



FLEXCO H D RIP PLATES

● Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.



FLEXCO H D BELT FASTENERS

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.

FLEXIBLE STEEL LACING CO.
4656 W. Lexington St., Chicago

Write for your copy.

FLEXCO HD BELT FASTENERS

Sold by supply houses everywhere

(Continued from page 92)

▲ N. Y. Cortland ... Bureau ... $1,262,000

▲ N. Y. Dansville ... $1,500,000

+ W. Va. Fort Lewis ... $565,000

COMMERCIAL BUILDINGS

BIDS ASKED

N. C. Durham ...

SOON LETS CONTRACT

N. C. Greensboro ...

CONTRACTS AWARDED

Conn. Stamford ... $440,800

Fla. St. Petersburg ... $425,000

Ill. Chicago ... $290,000

▲ Ind. Chicago ... $1,000,000

▲ Ind. Fort Wayne ... $1,000,000

▲ Ky. ...

Tex. Dallas ...

Tex. Houston ... $490,000

Tex. Lubbock ... $515,400

Tex. Pasadena ... $495,000

Tex. Pasadena ... $250,000

INDUSTRIAL BUILDINGS

BIDS ASKED

N. C. Fayetteville ...

SOON LETS CONTRACT

▲ O. Cleveland ...

Tex. Houston ...

Ont. Hamilton ...

LOW BIDDERS

Ont. Milton ... $200,000

CONTRACTS AWARDED

Calif. Sacramento ... $303,193

▲ Ind. Fort Wayne ... $6,500,000

La. New Orleans ... $68,000

La. New Orleans ...

Mo. St. Louis ...

N. C. Winston-Salem ... $95,000

O. Cleveland ... $200,000

▲ O. Rossford ...

▲ Tex. Dallas ... $2,500,000

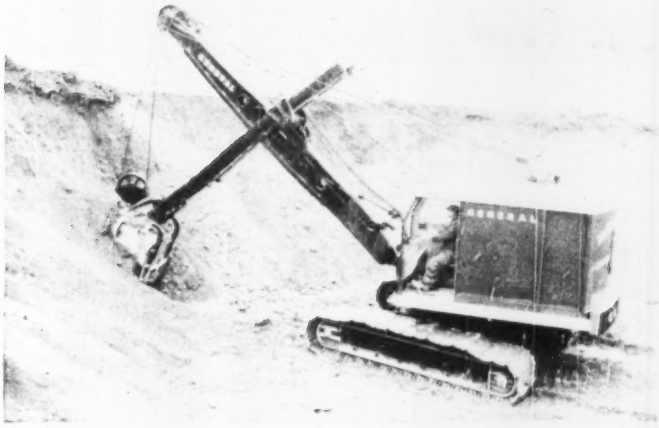
Tex. Houston ...

Tex. Houston ...

Va. Newport News ... $122,000

GENERAL

Model 420 takes the lead in the 1 cubic yard class



General's Model 420 is a real performance leader whether used as Shovel, Dragline, Clamshell, Lifting Crane, Hoe, Piledriver, or Magnet Crane. Hoisting, swinging, steering, swing brake, crowd and retract, and dipper trip are all air controlled for instant, accurate, velvet-smooth response. Patented Air Cushion Clutches, on swing reversing shaft and countershaft, eliminate jerking, grabbing, and time-consuming adjustments.

Rugged outside dipper handles give dipper better support for crowding, put less strain on shipper shaft, permit use of box-type boom which can better resist torsion. Independent Boombost and Independent Travel are standard. Choice of Diesel or gasoline power. When you invest, get the best—GENERAL.

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MARION, OHIO
AFFILIATED WITH THE OSGOOD COMPANY

POWER SHOVELS, CRANES
DRAGLINES, TRANSMITTERS
PILE DRIVERS & BACK HOES
CRAWLERS & WHEEL CRANES
DIESEL, GASOLINE OR
ELECTRIC POWERED
CAPACITIES ¼ TO 2½ CU. YD.

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CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.
MANUFACTURERS OF THE "CEMENT GUN"

CONTRACTS AWARDED

Fla., Miami—MOTOR COURT (Block Properties, Inc., contractor), motor court, by Norris Abbott, Miami, Fla., to cost $164,000. Engineer is Murray Axelrod. Architect $80,000. Owner (Morgan Contractor Co. is under Ch. 11).

Ky., Liberty—DRIVE-IN THEATRE, near Sanders, Herbert Smalley & Horace Peter, Liberty, drive-in theatre, Jamestown Rd., near city limits, separate contracts, $75,000. CD 2/27.

† N. C., Badin and Wadesboro—RADAR STATIONS, National Guard, Raleigh, radar stations, Stanly and Anson Counties, to Norman A. Smyer Co., Asheville, Type D, Ellsworth, $98,816. Radio Corp., Port Washington, N. Y., Type C, Ellsworth, $49,381.

† Oregon—AIRPORT, Portland, Airport Board, airport, taxiway extension, etc., at Astoria Regional Airport, to Peter Kiewit Sons' Co., Omaha, Neb., $79,583.

Tex., Dallas—TELEVISION STATION, Dallas Power & Light Co., Dallas, Power & Light Bldg., transmitting station, tower, antenna, etc., to Radio Corp. of America, Camden, N. J., $250,000; studio, power, and transmitting equipment, to Radio Corp. of America, Camden, N. J., $275,000.

† Washington—SHIPYARD FACILITIES, Portland, Terminal Iron & Metal Co., Box 3587, Portland, Ore., ground and waterfront extension, to cost $246,500, to Peterson Builders, Inc., Monadnock Bldg., San Francisco, Calif., low bid, $102,197. Bids asked.

Wyoming and Montana—RURAL ELECTRIFICATION, Rural Electrification Administration, Dept. of Agriculture, Washington, D. C., 10 projects, to cost $1,493,161, as follows: Big Horn County Electric Co-operative, Inc., Hardin, Mont., $300,000; Carbon County Rural Electric Co., Inc., Red Lodge, Mont., $493,161; Fergus Electric Co-operative, Inc., Lewistown, Mont., $300,000; Flathead Electric Co-operative, Inc., Kalispell, Mont., $300,000; Lincoln Electric Co-operative, Inc., Eureka, Mont., $300,000; Park Electric Co-operative, Inc., Livingston, Mont., $300,000; Ravalli County Electric Co-operative, Inc., Hamilton, Mont., $300,000; Sheridan County Electric Co-operative, Inc., Plentywood, Mont., $300,000; Southeastern Wyoming Rural Electric Association, Cheyenne, Wyo., $300,000; Wheatland County Electric Co-operative, Inc., Harlowton, Mont., $300,000.

Que., Montreal—TRANSIT EXTENSION, Montreal Transportation Commission, Montreal, Que., Can., extension of existing transit system, to cost $300,000.

Sask., Yorkton—THEATRE, Associated Theatres (Western) Ltd., Winnipeg, Man., Can., theatre, to cost $125,000.

PROPOSED PROJECTS

WATER SUPPLY

▲ Ala., Tuscaloosa—[illegible], $1,351,961.

Fla., Ocala—[illegible], $500,000.

O. M. Lamb—[illegible], $110,000.

Tex., Brady—[illegible], $150,000.

Tex., Bryan—[illegible], $250,000.

Tex., Center—[illegible], $150,000.

Tex., Commerce—[illegible], $160,000.

Tex., Cuero—[illegible], $125,000.

▲ Tex., Midland—[illegible], $2,000,000.

Tex., Mount Pleasant—[illegible], $750,000.

N. Y., Fishkill—[illegible], $600,000.

SEWERS, WASTE DISPOSAL

Fla., Lantana—[illegible], $450,000.

▲ Fla., Miami—[illegible], $1,500,000.

Ky., Carrollton—[illegible], $300,000.

Ky., Elizabethtown—[illegible], $350,000.

Tex., Bloomfield—[illegible], $100,000.

Tex., Center—[illegible], $225,000.

▲ Tex., Midland—[illegible], $1,525,000.

BRIDGES

▲ Ill., Chicago—[illegible], $1,062,000.

Nebraska—[illegible], $120,000.

Nemaha Co.—[illegible], $288,000.

Otoe Co.—[illegible], $102,000.

[illegible], $88,000.

[illegible], $63,000.

[illegible], $132,000.

STREETS AND ROADS

▲ Ala., Birmingham—[illegible], $2,560,000.

Ill., Decatur—[illegible], $666,565.

▲ La., Baton Rouge—[illegible], $913,000; [illegible], $738,000; [illegible], $224,000; [illegible], $687,000; [illegible], $263,000; [illegible], $88,000; [illegible], $263,000; [illegible], $120,000; [illegible], $1,035,000; [illegible], $28,000; [illegible], $78,000; [illegible], $48,000; [illegible], $147,000; [illegible], $411,000.

Tex., Houston—[illegible], $250,000.

Tex., Pasadena—[illegible], $200,000.

▲ Ontario—[illegible], $1,000,000.

EARTHWORK, WATERWAYS

La., Vidalia—[illegible], $350,000.

AIRPORTS

Tex., Dallas—[illegible], $800,000.

† Tex., Randolph Field, San Antonio—[illegible], $100,000.

LATIN AMERICA

Mexico, Mexico City—[illegible], $200,000.

Mexico, Mexico City—[illegible], $600,000.

Mexico, Mexico City—[illegible], $600,000.

PUBLIC BUILDINGS

▲ Ark., Little Rock—[illegible], $18,930,000.

▲ Ga., Columbus—SCHOOL (Mirkey—Mustogee Co.), votes $4,250,000 school issues. CD 5/19.

Ind., New Castle—DORMITORY (State P. Wks. & Supply Bd., W. R. Mybeck, dir., State House, Indianapolis, I.), and part 2 story, fireproof, brick, stone, concrete, steel, reinforced, women's dormitory, $500,000. CD 12-22-43.

▲ Ky., Owensboro—APARTMENTS (Owensboro Municipal Housing Comm., P. O. Box 471, plans by Merriwether, Mayer & Assoc., 226 Starks Bldg., Louisville, Ky.), 3 and 3 story brick, simple apartments, $6,000,000.

▲ La., Baton Rouge—[illegible], $700,000; [illegible], $1,000,000.

La., New Iberia—SCHOOL (MRK—[illegible], Fourth School Bd., New Iberia), election July 24, school issues, [illegible], $725,000.

▲ La., New Orleans—MUSEUM (City—[illegible], State Park Service), new wings, repairs and renovation, $2,500,000.

▲ Mich., Grand Haven—SCHOOL (S. Edw. E. H. Bertsch, supt., Grand Haven Pub. Schools), high school, [illegible], $1,600,000.

Mo., St. Louis—[illegible], $600,000.

Mo., Webster Groves (St. Louis 19, P. O.)—HOUSING, [illegible], 224 E. Manor Blvd., for Housing Corp., Webster Groves Chamber of Commerce, 126 Gore Ave., plans by Widmer, Jay & Kelly, and Arthur N. T. St. Louis, Zone 1, Story Bond, 84 unit brick, concrete apartment, $4,000,000.

N. J., Asbury Park—HOUSING, Asbury Park Public Housing Authority, 10 Asbury Ave., Asbury Park, to cost $3,442,000.

▲ N. J., Bayonne—[illegible], $1,167,000.

▲ N. J., Hoboken—[illegible], $7,000,000.

▲ N. J., Jersey City—[illegible], $5,250,000; [illegible], $600,000; [illegible], $400,000.

▲ N. J., Newark—[illegible], $637,000.

▲ N. J., Perth Amboy—[illegible], $3,500,000.

▲ N. J., West New York—[illegible], $461,000 and $400,000.

▲ N. Y., Cooperstown—[illegible], $1,800,200.

▲ N. C., Raleigh—[illegible], $774,000; [illegible], $340,000; [illegible], $1,500,000; [illegible], $450,000.

▲ Okla., Oklahoma City—[illegible], $1,407,200.

Pa., Johnstown—[illegible], $500,000.

▲ Pa., Scotland—[illegible], $1,200,000; [illegible], $425,000; [illegible], $250,000.

▲ S. C., Charleston—[illegible], $1,300,000.

Tex., Brownsville—[illegible], $500,000.

▲ Tex., Dallas—[illegible], $1,500,000.

▲ Tex., Galena Park—[illegible], $150,000; [illegible], $250,000; [illegible], $1,000,000.

▲ Tex., Galveston—[illegible], $2,500,000.

▲ Tex., Houston—[illegible], $150,000.

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HIGH COSTS!

The Sludge Blanket in the Permutit Precipitator acts as a filter...SAVES YOUR EXPENSIVE CHEMICALS!

The positively agitated uniform sludge filter in the Permutit Precipitator will save you up to 50% in space and 75% in time of treatment too!

The Permutit Precipitator offers you the newest and most efficient means of removing impurities from your water. It does this by precipitation, adsorption, settling, and upward filtration. Write for full details to the Permutit Company, Dept. ENR-7, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

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WATER CONDITIONING HEADQUARTERS

Permutit

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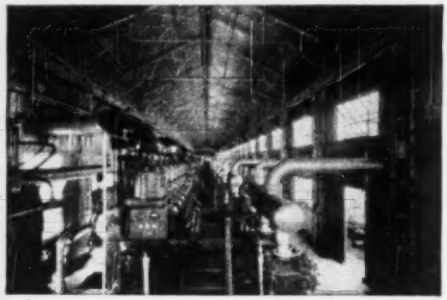
Custom Built to your Own Business Requirements

But Less Costly as Constructed of Standard Sections



Allied Steel Buildings are custom built to your needs making them ideal for practically every purpose. But, since they are constructed of standard sections the completed job costs less as there is no wastage of material. Allied Buildings may be enlarged or reduced in size to meet any need and may be moved to a new location with almost 100% salvage. They can be furnished insulated.

Allied Buildings are used for Alfalfa Dehydrators, Asphalt Plants, Canneries, Carbon Black Plants, Cotton Gins, Cotton Oil Mills, Machine Shops, Oil Refineries, etc. *Write for Catalog*

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COMMERCIAL BUILDINGS

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UNCLASSIFIED

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SINCE 1902
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WESTERN WATERPROOFING CO.
Engineers & Contractors
SYNDICATE TRUST BLDG., ST. LOUIS 1, MO.

CONSTRUCTION REPORTS-Second Section

WATER SUPPLY

BIDS ASKED

Ind. Crown Point. U.S.

Ga., La Grange. U.S.

Tenn., Nashville. U.S.

Pa., Greensburg. U.S.

▲ Tex., Dallas. U.S.

Tex., Pasadena. U.S.

N. J., Camden. U.S. $7,149,

Mass., St. Charles. U.S.

† Alaska, Douglas. U.S.

† Alaska, Skagway.

Calif., San Francisco. U.S.

Tex., Pasadena.

LOW BIDDERS

Calif., Eureka. U.S.

$751,740

Wash., Brookline. U.S.

Apr. $449,600; ... $762.

SEWERS, WASTE DISPOSAL

BIDS ASKED

N. Y., New York.

BRIDGES

BIDS ASKED

STATE HIGHWAY LETTINGS

Gloucester, Camden and Burlington Counties—Contr. S...

LOW BIDDERS

▲ New Jersey. ... $2,124,446.

... $2,375.

... $695,000.

CONTRACTS AWARDED

▲ New Jersey. ... $470,825.

▲ ... $51,747,280.

$1,106,395.

$67,607.

SAFE MOVE
FOR YOUR COSTLY EQUIPMENT
SMART MOVE
GET TO THE NEXT JOB WITHOUT LOST TIME

with JAHN Heavy Duty TRAILERS

WHETHER your load weighs five tons or a hundred, you can depend on Jahn Trailers for safe and economical transportation to the next profitable job. They're famous for the rugged construction that means strength and stamina under the toughest conditions. From Jahn Tilt Trailers for your light equipment to big, sturdy tandem or multiple axle units for your heavyweight loads, there's a size and model to suit your needs. Investigate Jahn Trailers first—see your Jahn distributor today.

JAHN TRAILER DIVISION OF PRESSED STEEL CAR COMPANY, INC.
603 N. Michigan Ave., Chicago 2, Ill.

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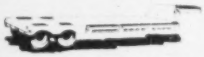
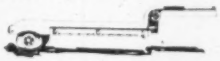


Tandem Axle Trailers

Single Axle Tilt Trailers



Single Axle Trailers

STREETS AND ROADS

BIDS ASKED

STATE HIGHWAY LETTINGS

LOW BIDDERS

CONTRACTS AWARDED

EARTHWORK, WATERWAYS

BIDS ASKED

LOW BIDDERS

Engineers and Architects

will find this 40 page pictorial bulletin full of outstanding jobs that were built with Teco timber connector construction, glued laminated timbers and Lamella timber construction:

Churches	Hangars
Dining Halls	Warehouses
Amusement Centers	Stores
Towers	Garages
Farm Buildings	Grandstands
	Gymnasiums

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affiliated with
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PILE HAMMERS and EXTRACTORS

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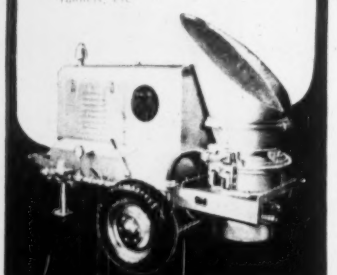
"Welding with Concrete" best describes the new CMC JETCRETE method of pneumatically applying concrete. JETCRETE is the most nearly perfect concrete known today. Wherever and whenever used, JETCRETE has done the job better, faster —and at lower cost. The machine with a thousand uses!

- *BUILDING* ... walls, roofs, partitions, fences, fire retards, etc.
- *REPAIRING* ... Disintegration of all kinds—old buildings, bridges, stacks, bunkers, dams, etc.
- *WATERPROOFING* ... Reservoirs, tunnels, tanks, drains, fissures, water basins, etc.
- *FIREPROOFING* ... Wood, structural steel ... buildings and mines, etc.
- *PRESERVING* ... Brick, concrete, steel, tile, stucco, wood, iron, spillways, turbine chambers, piers, sewers, tunnels, etc.



Write for illustrated bulletin No. JO-348 showing JETCRETE in action.

CONSTRUCTION MACHINERY COMPANIES
WATERLOO, IOWA

▲ Wash ... Seattle ... $1,942,467

CONTRACTS AWARDED

▲† Minn ... Minneapolis ...

▲† Texas ... Tullahoma ... $2,963,164

▲† Washington ... $2,572,544

▲† Wyoming ... $1,011,773

AIRPORTS

BIDS ASKED

† Alaska ... Fairbanks ...

CONTRACTS AWARDED

† Calif ... March Field ... $520,024

Mass ... Worcester ... $767,890

LATIN AMERICA

Bolivia ...

PUBLIC BUILDINGS

BIDS ASKED

Ark ... Little Rock ...

▲ Ill ... Chicago ...

Mass ... Dalton ...

N. Y. ... Brooklyn ...

N. Y. ... Long Island City ...

O. ... Dayton ...

Pa. ... Norristown ...

▲ N. J. ... Bayonne ...

N. Y. Long Island City ...

Tenn ... Savannah ...

† Wash ... Richland ...

Fla ... Orlando ...

N. Y. ... Brooklyn ...

O. ... Toledo ...

Calif ... Inglewood ...

Calif ... Yountville ...

▲† Okla ... Oklahoma City ...

Tex ... Austin ...

▲ Calif ... Santa Monica ...

(Continued on page 104)

corrosion prevention at lowest yearly cost with the METCO METALLIZING SYSTEMS

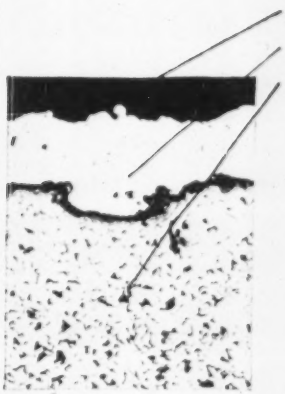


Photo-micrograph (100X) shows ideal base provided by the sprayed metal for METCOSEAL which provides years of protection in itself. When the METCOSEAL finally weathers away the pure zinc or aluminum still provides perfect electro-chemical protection against corrosion.

Engineered Techniques for Corrosion Prevention under specific service conditions for: Tanks—Bridges—Piling—Pipe Lines—Ship and Boat Hulls and Superstructures—Refrigeration Equipment—Fabricated Steel Products.

What the Metco Systems Are

The METCO SYSTEMS provide pure zinc or aluminum coatings properly treated to withstand a wide range of corrosive conditions. Each METCO SYSTEM is set up in specification form to meet given corrosive conditions, such as industrial, rural, humid or sea coast atmospheres, marine work, salt or fresh water immersion, etc. In most systems the zinc or aluminum is applied by metallizing directly to the steel base and then given a specific organic treatment to meet specific requirements. In other SYSTEMS the pure metal is used as applied and requires no after-treatment. Provision is also made for finishing in a number of colors to meet appearance requirements.

Why Developed

The METCO SYSTEMS have been developed because of the present high annual cost of protective coatings due to their limited life. METCO SYSTEMS make possible longer life at lower annual cost.

How They Work

The corrosion resistant qualities of zinc are well known. Galvanizing is specified on many jobs where paint would fail rapidly. However, galvanizing is limited by the size of equipment or structures which can be handled and by the thickness of metal which may be applied. The application of Metallized Zinc is not limited in these respects; any size structure can be treated, regardless of location, and any thickness of zinc may be applied.

In atmospheres containing sulphur gases pure aluminum is used, providing even greater protection than zinc.

For many conditions the life and appearance of both the zinc and aluminum can be enhanced by the specific organic treatments with METCOSEAL coatings as specified in the various systems. METCOSEAL coatings are vinyl, vinyl-alkyds, chlorinated rubber or other materials, applied by brush or spray, all thoroughly tested and compatible with the pure metallized zinc and aluminum as recommended.

FREE BULLETIN AVAILABLE. Bulletin 93 describes the eighteen basic METCO SYSTEMS, typical applications. With it you can choose the SYSTEM fitting your particular corrosion problem and then obtain the SYSTEM specifications covering the job. Write for it. No obligation, of course.

The following trade names are the property of Metallizing Engineering Co., Inc.
METCO® • METCOSEAL ®REG. U.S. PAT. OFF.

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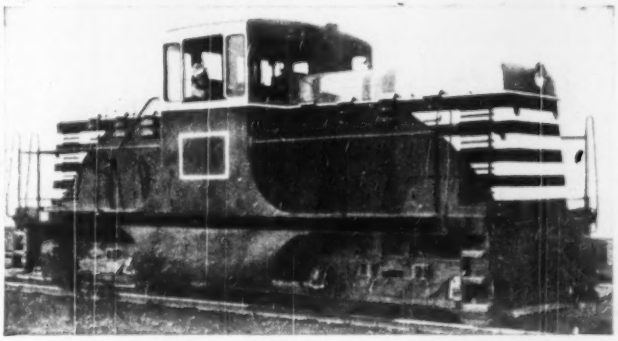

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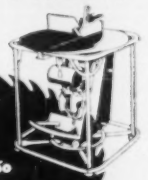

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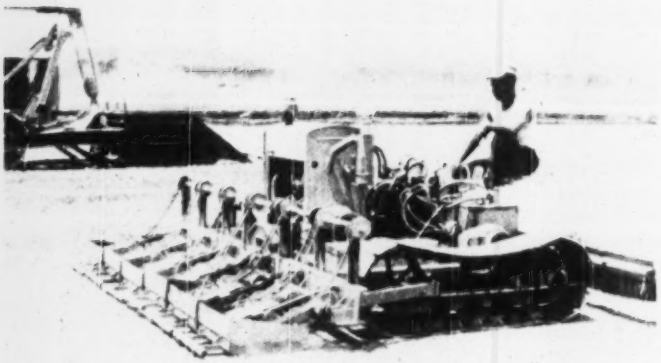

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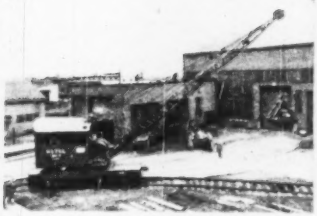

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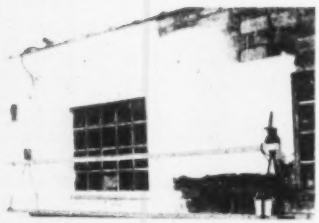

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Continued on page 118

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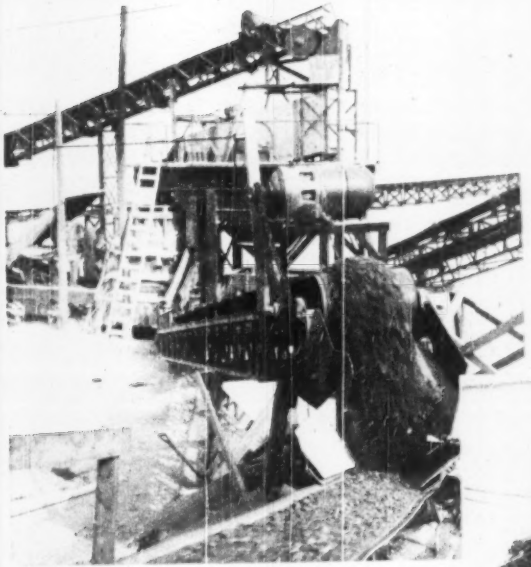

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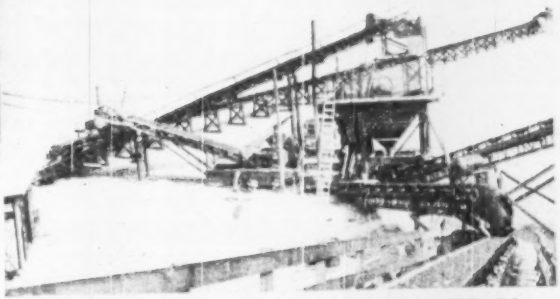

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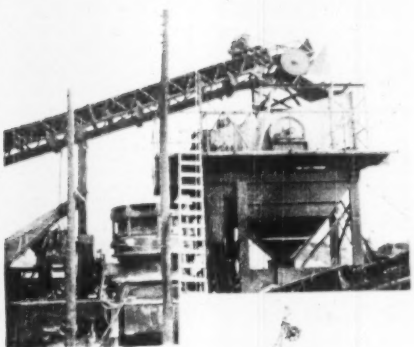
Portable

CRUSHING-SCREENING PLANT



The No. 48 Telsmith Standard Gyrasphere Crusher in closed circuit with 5' x 12' Telsmith 3-deck Pulsator, make up this portable plant's crushing-screening unit.

The portable feeder-hopper unit has a 36" x 6' Telsmith Heavy-Duty Plate Feeder.

● Turning out ballast for the C. & NW Ry.—that's minus 1½" sand and gravel with oversize crushed and some sand eliminated—this Telsmith Portable Crushing-Screening-Loading Plant of Foley Brothers, near Algonquin, Ill., has a capacity of 2000 cu. yds. per 9½ hrs. They load a 50-yd. car in 15 minutes. The No. 48 Telsmith Standard Gyrasphere Crusher in closed circuit with a 5' x 12' Telsmith 3-deck Pulsator, and a 30" x 70' Telsmith steel truss Conveyor give the plant a compact, mobile crushing-screening unit of maximum capacity. Dependable, even flow is provided by the portable hopper-feeder unit with its 36" x 6' Telsmith Heavy-Duty Plate Feeder. Find out about Telsmith Portables with Gyrasphere Crushers in Bulletin 265.

P-55

SMITH ENGINEERING WORKS, 500 E. CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Bocheck Equipment Co., Milwaukee & Modern Rock, Wis. — R. G. Moeller Co., Detroit 27 & Kalamazoo, Mich. — W. B. Thompson Co., Iron Mountain, Mich. — Hawkeye Mchy. Co., Des Moines, Iowa — Smith, Inc., Fargo, N. Dak.

Rosholt Equipment Co., Minneapolis 6 & Duluth 7, Minn. — Empire Equipment Co., Sioux Falls & Rapid City, So. Dak. — Montana Powder & Exptr. Co., Helena, Montana — Constructors Exptr. Co., Denver 5, Colorado

General Machinery Co., Spokane 1, Wash. — Mussens Canada Limited, Montreal, P. Q.—Fredericton, N. B.—Toronto, Ont.

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New booklet presents a factual record of M-C & S's ability to solve the most challenging construction problems. Your copy will be sent immediately upon request to Dept. ENR

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gun swivels 360 deg. and locks in any cutting tangent. Power can be furnished by electric drill, air drill, or through a flexible shaft. — THE NATIONAL MACHINE TOOL & SUPPLY CO., 13 N. 1st St., MINNEAPOLIS, MINN.

Portable Paint Sprayer

Plant uses jet propulsion principle to supply pressures up to 40 lb with out pump or compression tank. Powered by electric motor, the Genwinit unit can be used for spraying paints, adhesives, cleaning solutions, or for air pressure cleaning of machinery. Trigger control on gun eliminates nozzle adjustment during operations, and permits controlling amount of spray without stopping the job. — GENWINIT CORP. OF AMERICA, 701 SENECA ST., BUFFALO 10, N. Y.

Tractor-Drive Generators

Emergency electricity in standard voltages can be obtained by a new line of Tractor-Drive generators. Belt driven, they are available in 5,000, 7,500, and 10,000-w. capacities, with 115-230-volt, 60-cycle current. Control box permits regulating generator speed to produce correct voltage. Circuit breaker guards against overloads. — D. W. ONAN & SONS, INC., 800 STINSON AVE., MINNEAPOLIS 5, MINN.

Blasting Galvanometer

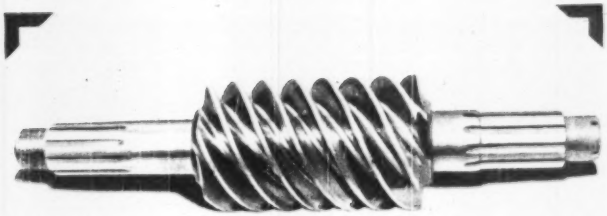
Adjustable blasting galvanometer is said to provide accurate resistance readings in ohms even when the firing cable is not at full strength. Special features are designed for extra safety not found in testing blasting circuits before firing. The Allen No. 4 galvanometer is calibrated to measure as few as three ohms, but it may be used to check small circuits such as a single blasting cap. Continued on page 120

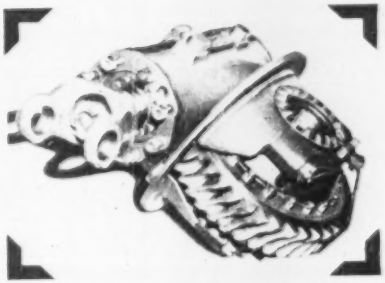
STANDARD ENGINEER'S REPORT

DATA

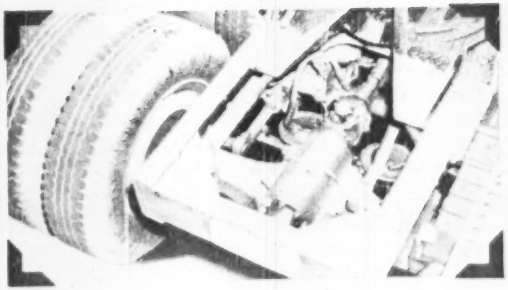
LUBRICANT	RPM Gear Lubricant (compounded)
UNIT	"Semi" diesel Truck
PART	Differential carrier assembly—Timken Worm 3002
CONDITIONS	Long Distance freight haul—high speeds
LOCATION	San Francisco—Los Angeles
FIRM	Hills Transportation Co., San Francisco

Practically no wear on worm gear in 235,000 miles





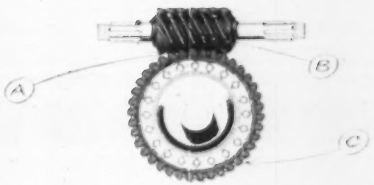
IN A TRANSPORT TRUCK DIFFERENTIAL lubricated with RPM Gear Lubricant (Compounded), this worm gear had been in constant service for 235,000 miles when the unit (Timken) was overhauled. Teeth were still in excellent condition as the picture shows. The gear was replaced because of a loose spline. This was only the second overhaul for the differential unit in 648,326 miles of truck service.



TWO "DROP-IN" UNITS of the same type were operated together in two tandem differentials of this transport truck. They pulled average daily loads of twenty tons on a 110-day run in regular common-carrier service.

Because RPM Gear Lubricant (Compounded) has very high oiliness qualities (lubricity), it is especially valuable for the lubrication of truck worm gears. It is also used in universal joints, chassis and other parts of trucks, buses and tractors of all kinds. RPM Multi-Purpose Gear Lubricant is recommended

How RPM Gear Lubricant (Compounded) prevents wear in worm and conventional gears



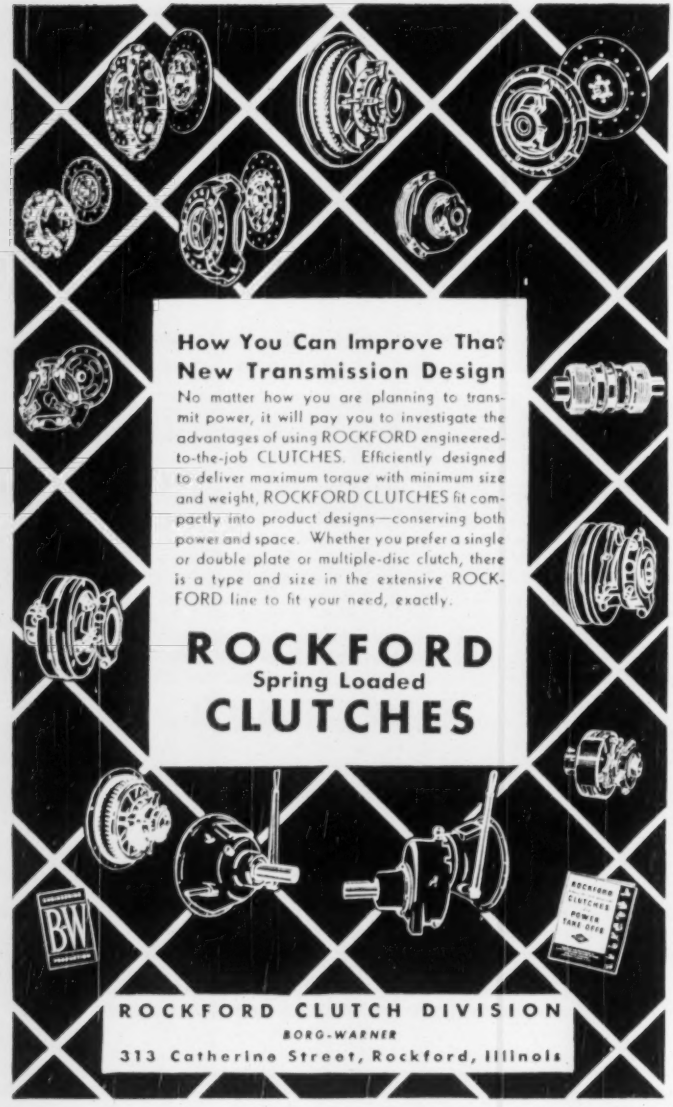
A. Made from paraffine stocks with special compounds that help prevent a rough ride—give extra tooth protection at heavy loads and overloads.

B. Has extra resistance to oxidation—resists separation, assures lubrication at high temperatures.

C. Contains foam inhibitor—prevents wear-away pressure.

lem products of any kind, or the name of your nearest distributing agent, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Perth Amboy, N.J., Chicago, New Orleans
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado


How You Can Improve That New Transmission Design
No matter how you are planning to transmit power, it will pay you to investigate the advantages of using ROCKFORD engineered-to-the-job CLUTCHES. Efficiently designed to deliver maximum torque with minimum size and weight, ROCKFORD CLUTCHES fit compactly into product designs—conserving both power and space. Whether you prefer a single or double plate or multiple-disc clutch, there is a type and size in the extensive ROCKFORD line to fit your need, exactly.
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and may be used as an interrupter in detection of stray currents—especially useful in underground blasting work. —ATLAS POWDER CO., WILMINGTON, DELA.

Fire-Resistant Wallboard

Firestop gypsum wallboard when applied as a single 5/8-in. thick single layer on both sides of a load-bearing wood-stud partition has a fire-resistance rating of one hour. A single layer of 1/2-in. thickness on similar construction has a 45-min rating. Firestop Bestwall may be used for new construction or remodeling. It is available in sheets 4 ft wide, 6 to 12 ft long, and 1/2 and 5/8 in. thick.—CERTAIN-TEED PRODUCTS CORP., 120 E. LANCASTER AVE., ARDMORE, PA.

Vibrating Sieve Shaker

A vibrating action of test sieve shaker is produced by electromagnetic drive, resulting in 3,600 vibrations per minute from a 1-hp, 60-cycle ac current. The shaker has no bearings, gears, belts, or pulleys. The shaker holds six 8-in. dia. sieves. Reset timer provides accurately timed test periods.—SYNTRON CO., 528 LEXINGTON, HOMER CITY, PA.

Curved Jaw-Crusher Plate

By using a curved surface, the Traylor jaw crusher plate is said to cut power costs, reduce percentage of slivers, fines, and to produce a more uniform, cubical aggregate. These plates are also said to eliminate crusher packing and choking, and to allow free fall of material as it progresses through the crushing chamber. This is accom-

(Continued on page 123)

TOUGHEST for the MEANEST

The meanest digging jobs and *ESCO* All-Cast dippers naturally belong together. For these tough, rock-type dippers have proved their ability to lick the most punishing jobs—clean them up without lost time and with almost no maintenance...and be ready to tackle the next job.

Reason for the unexcelled record of *ESCO* All-Cast dippers may be summed up by two simple facts:

All-Manganese Construction

All parts of the dipper are cast of *ESCO* Manganese Steel, the shock and wear resisting steel that becomes highly polished in use, gets harder, tougher the more it works.

Bulk Eliminating Design

Due to wear resisting properties of manganese steel, *ESCO* All-Cast dippers need not be made excessively heavy to allow for wear. Bulk is further reduced by hollow back beam construction. Fast, efficient digging results from clean, streamlined cutting lip with integral tooth holders; flaring outside teeth for full bite; tapered box for quick, easy discharge.

Ask for Descriptive Literature

ESCO catalog 182 gives the full story of *ESCO* All-Cast dippers, including sizes and dimensions and details of construction. A copy of this catalog is yours for the asking. Get it from the *ESCO* representative nearest you, or fill in and mail the coupon.

ESCO DIPPERS, HOE DIPPERS, DRAGLINE AND COAL LOADING BUCKETS

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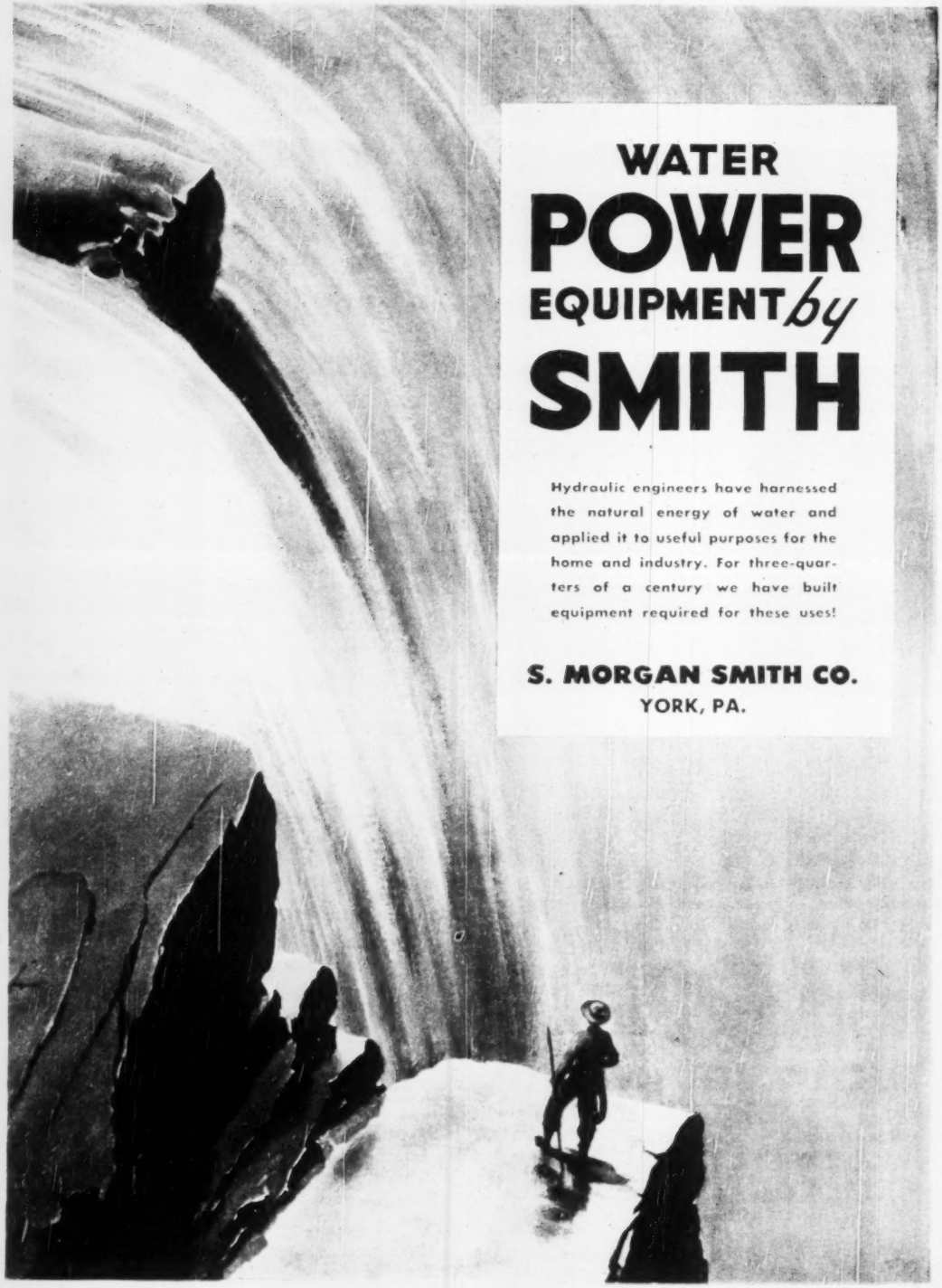
DANVILLE, ILLINOIS — PORTLAND, OREGON — VANCOUVER, B. C.

ELECTRIC STEEL FOUNDRY



WATER POWER EQUIPMENT *by* SMITH

Hydraulic engineers have harnessed the natural energy of water and applied it to useful purposes for the home and industry. For three-quarters of a century we have built equipment required for these uses!

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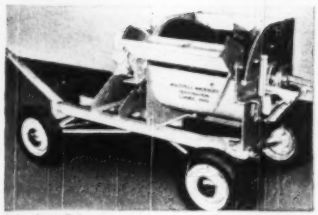
YORK, PA.

plished by providing each succeeding zone in the crushing chamber with a greater capacity than the preceding zone.—Traylor Engineering & Mfg. Co., 140A Mill St., Allentown, Pa.



Multi-Blade Mixer

Portable multi-blade mixer is powered by electric motor or gasoline or diesel engine. Height of discharge cone is located for use with standard wheel barrows. Mixer is mounted on truck provided with four pneumatic-tired automobile wheels. The Multimix mixer is produced in 3, 5, 7, and 12 ft capacities.—Multiplex Machinery Corp., Lyndon, Ohio.

Dual-Fuel Engine

Heavy duty engines, power units, and generator sets burn either natural gas or diesel fuel. Operation on either fuel is determined by positioning a single lever. Feature of the Murphy engine is that it employs high-compression combustion. Three models are now available, ranging from 155 to 190 hp.—Murphy Diesel Co., 5341 W. Burnham St., Milwaukee 14, Wis.

Tilting-Arbor Saw Table

Lightweight saw table, 44 lb, is easily carried in one hand. Model 5500 tilting-arbor saw table increases utility of the Speedmatic portable saws. The table can be mounted on saw horses or on 52 in. steel legs available as an accessory. The 24x30-in. table, with 45-in. front and right rule, provides a maximum ripping capacity of 24 in.—Porter-Cable Machine Co., 5204 N. Salina St., Syracuse 5, N. Y.

Battery-Cell Tester

King Model CC-5 cell tester has a 2½-in. meter calibrated to indicate charge of cell or battery. A built-in

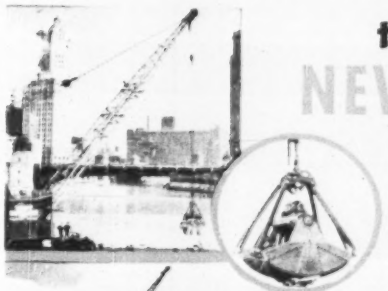
(Continued on next page)

1947 1948 1949 1950

Everthing Points FORECAST

TO A BIGGER CONSTRUCTION YEAR and MORE BOOMS with..

Owens will point toward NEW JOBS!



TODAY, contractors can successfully cope with competitive bidders by equipping themselves with construction machinery that will "pay its own way" by doing more of better work in less time, with lower operating cost.

The "Performance Earned" top rating of Owen Buckets by progressive contractors everywhere is fortified by continued principles of sound design and rugged construction with highest grade materials.

OWEN builds buckets for each and every job requirement

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Write for Bucket or Grapple Catalog. Specify Rock Handling, Scrap Iron or Pulpwood Grapple

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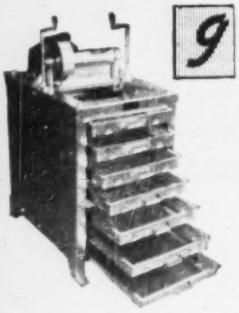
GILSON
Mechanical
Testing Screen



Makes test quickly and accurately
Two to seven separations simultaneously
Screen trays independently removable
Trays balanced to same tare weight
Visible separation to refusal
Few moving parts
Sturdy construction
Size range 4" to 200 mesh
Screen trays available with either square or round openings.

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You can have power wherever you need it—and as much as you need—when you take along a Fairbanks-Morse portable generating set.

Fairbanks-Morse generators are available in capacities from 600 to 35,000 watts—A.C., D.C., or A.C.-D.C., according to type.

They are widely used in resorts, cabins, sawmills, farms, radio stations, camps, ranches and many other industrial and commercial enterprises.

For complete information about a generator to meet your needs, see your local Fairbanks-Morse dealer, or mail the coupon.

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Please send full details about your power generating sets for portable or permanent service.
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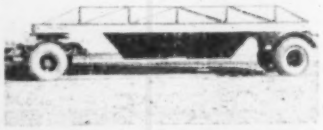
Address RD
City State

cell voltage. It has a temperature-compensated load of approximately 200 amps (average engine starter load) to provide an accurate battery test.—ELECTRIC HEAT CONTROL CO., 9123 INMAN AVE., CLEVELAND 5, OHIO.

Pneumatic Tired Rollers

Water-ballast bodies on BMCO pneumatic-tired rollers are equipped with large filler plates and plugs in the top of the body. Clearout plates on the bottom permit ballasting with water or water and sand. The clear-out plates are sufficiently large to allow for quick and easy flushing out of sand. Independent wheel action is a feature of the roller.—LEWIS BROWNING MFG. CO., 111 HOUSTON AVE., SAN ANTONIO 6, TEX.



Center-Dump Semi-Trailer

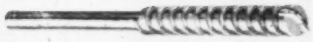
Features of new model center-dump semi-trailer include low cost, light weight, compliance with bridge and axle laws, and wide range of applications. Adjustable latch mechanism allows pre-setting dumping opening from 4 to 36 in. Hopper bottoms are especially designed for efficient handling of materials specified by the purchaser. Main frame members protrude hopper, leaving it clear of obstructions and interior bracing.—ONTARIO STANDARD CO., COUNCIL BLUFFS, IOWA.

Rubber Pinch Valve

Features of this rubber pinch valve include long wear, flexibility offsets misalignment in pipes, no packing or repacking is required, absorbs vibration, completely water-jammed, and affords a positive seal in closed position. Valves are available with cutting abrasive and corrosive-resistant compounds.—UNITED STATES RUBBER CO., ROCKEFELLER CENTER, NEW YORK 20, N.Y.

Vertical Turbine Pump

Glass-lined bowls and bronze impellers are features of the Weismaster vertical turbine pumps. These pumps are adaptable to deep wells as small as 6 in. dia. Equipped with vertical hollow-shaft electric motors, they deliver 15 to 115 gpm. and under certain conditions, 140 gpm. or more. Design features include adjustment on drive head to change capacity or pressure, closely spaced synthetic rubber bearings, and 1-in. stainless steel shafting. An oversize foot valve holds water in column. Valve face is rubber lined and mounted in inclined position to prevent sticking or clogging in presence of sand.—A. O. SMITH CORP., 3533 N. 27TH, MILWAUKEE, WIS.



Concrete Drill Bits

Centerless design concrete drill bits are available in a range of sizes from ⅜ to 1 in. Feature of this drill is elimination of the center point, said to result in faster drilling with less pressure. These drill bits can be used with ordinary electric drills at speeds from 500 to 1,200 rpm. The company offers free resharpening and repair service for the life of all its drills.—TUTTLE TOOL MFG. CO., 1935 N. EAST OAKS PARKWAY, CHICAGO.

New Product Briefs

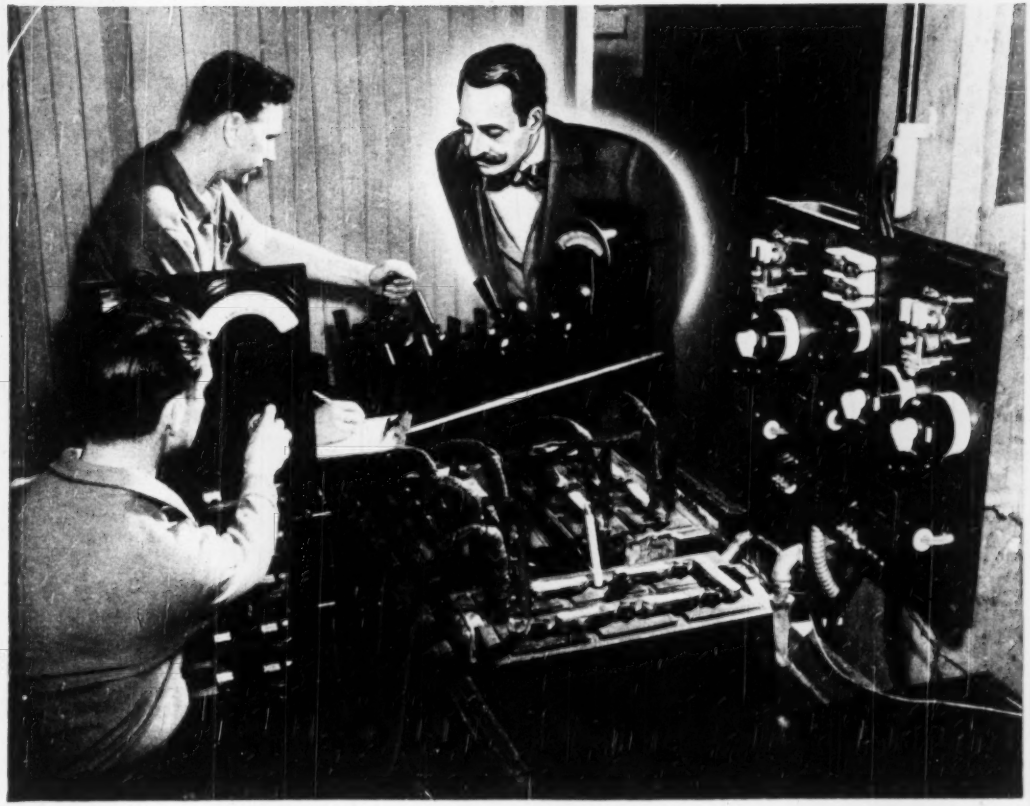
Power feed attachment permits using radial arm saws for straight ripping, bevel ripping, molding, power-feed shaping, planishing, grooving, and rabbeting. The DeWalt attachment can be moved completely out of the way once power feed work has been completed.

Water-repellent coating of a transparent nature is used for above grade exterior masonry walls. Rinetite No. 1 coating contains polysiloxane resin.—Miller Rinetite Mfg. Co., Inc., St. Louis 4, Mo.

Threadless pipe fitting is easily installed using a hack saw and monkey wrench. Tested to withstand pressures of 2,000 psi., they are manufactured for use with 1 to 11-in. pipe in tees, couplings, and elbows.—Made by Union Products Co., Minneapolis, Minn.

Plastic face mask replaces leather for American Optical's Nos. 501 and 510 goggles. Principal features are that it can be sterilized and will not shrink or curl when wet.

FM communication unit for the 30 to 50-megacycle band is available from Radio Specialty Mfg. Co. of Portland, Ore. Total weight including self-contained batteries is less than 25 lb. Output can be as high as 7 watts.



This overcharge test, Mr. Diesel, proves that Exides can "give it and take it"

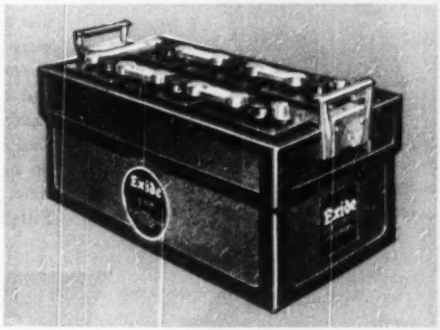
The Exide overcharge test is rough and rugged. Plates and separators are subjected to *continuous* overcharge . . . not for a short time, but as long as 48 weeks, and at an average temperature of 100° F. The purpose: to *make certain* that Exide Batteries give you maximum service life.

Results of this and other tests prove that you can count on Exide Diesel Cranking Batteries for:

- high maintained voltage—a *quick breakaway* and *high cranking speeds*.
- long life—low depreciation, less frequent replacements.
- low costs—operating, maintenance, repair.
- ruggedness for heavy-duty service in all climates.

Get top performance, long battery life and economy with Exide Batteries. Use them for all your Diesel cranking—buses, trucks, trailer-tractors, off-the-highway equipment, ships, power plants, Diesel-electric locomotives.

LET EXIDE'S ENGINEERING STAFF, the largest in the industry, help you find the right answer to any Diesel cranking problem.

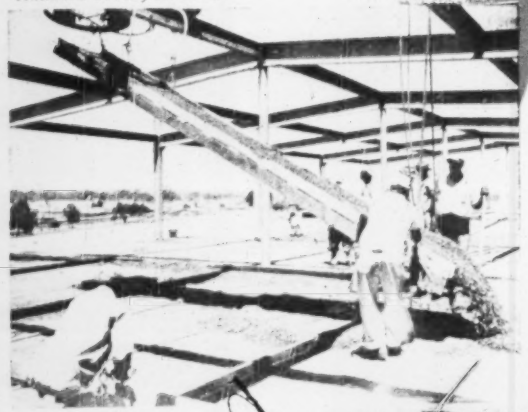


THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

1888 . . . DEPENDABLE BATTERIES FOR 62 YEARS . . . 1950

how Pittsburgh Steeltex beat the horses at Bay Meadows

While pouring was in progress work continued on the floor below.



Completed renovation of Bay Meadows Track, San Mateo, California

When it was decided last year to extensively remodel and enlarge the famous Bay Meadows Race Track at San Mateo, California, there were just four months grace before the opening race. In constructing the vast concrete decks called for in the plans, it was mandatory that materials be used that would provide speed and economy on the job, and maximum safety for a vast number of spectators. *That's why Pittsburgh Steeltex Floor Lath was the best bet at Bay Meadows* . . . why 200,000 square feet were used on the job. Crews were able to continue normal operations underneath the floors as pouring was in progress, and the slabs were properly reinforced with famous Steeltex heavy, welded wire mesh . . . properly cured because moisture was retained by waterproof backing. For detailed information on how Steeltex can help you win *your* race with construction time, see Sweet's or write for catalog D.S. 135, Dept. ENR, Pittsburgh Steel Products Co., Grant Building, Pittsburgh 30, Pa.

Pittsburgh Steel Products Company

A Subsidiary of Pittsburgh Steel Company

Pittsburgh 30, Pa.

Manufacturers' Publications

Uses of Aerial Surveys—Typical uses and advantages of aerial surveys are illustrated and described in this 24-p catalog. Types of surveys listed include those for highway planning, flood control, city planning, railroads, and city and county maps. The catalog describes equipment used in preparing aerial surveys.—AERO SERVICE CORP., 236 E. COURTLAND ST., PHILADELPHIA 20, PA.

Drafting Room Supplies—Listed in Berger's Catalog V is a complete line of drawing instruments, slide rules, T-squares, curves, triangles and scales. Feature of the T-squares, curves, and protractors is that they are produced in cyclest green plastic. The drawing instruments are made in the U.S. zone of Germany.—BERGER SCIENTIFIC SUPPLIES, INC., 342 MADISON AVE., NEW YORK 17, N. Y.

Rental Instruments—Bulletin describes an instrument rental service designed for those who use certain instruments only infrequently. These instruments include: Recording accumeters, recording heads, voltmeter, recording voltmeter, and current transducer.—INSTRU-RENTAL CO., 411 A. ADAMS BLDG., WASHINGTON 5, D. C.

Stationary Compressors—A catalog line of stationary compressors is illustrated and described in Bulletin JCS-0. Models listed include the JC-15, JC-25, JC-50, JD-75, and JC-90. These range in capacity from 60 to 253 cfm at 100 lb. Complete specifications and dimensions are listed for each of these units. Also described in the catalog are compressor pipeline accessories, portable units, and receivers.—THE JAEGER MACHINE CO., 550 W. SPRING ST., COLUMBUS 16, OHIO.

CONTRACTORS' FIELD OFFICE TRAILER

Designed by Road Contractor

26' Aluminum Body—8' Wide
2 Rooms—2 Built-in Desks
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Closets—Drawers—etc.

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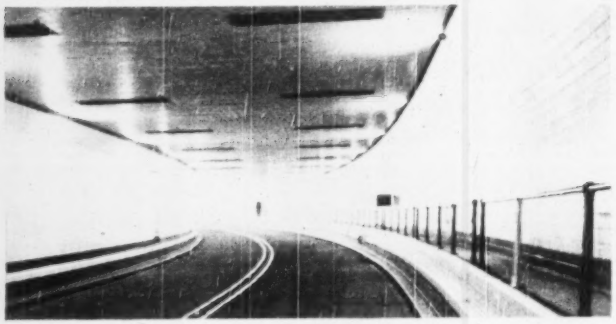


Vehicle tunnel designs stand test of time

Late in May, New York opened the latest of four tunnels that carry motor traffic under the waters surrounding Manhattan Island. It is the Brooklyn-Battery tunnel—longest and most costly of the four.

Except for its continuous fluorescent lighting, the new tunnel is strikingly similar to the first of these underwater tubes—the Holland Tunnel, opened 25 years ago this coming fall. The fact that so few changes have been made as a result of experience in operating the Holland Tunnel and in building and operating the Lincoln and Queens-Midtown tunnels reads as a high tribute to the engineers who created the first tunnel. Their work was a pioneering operation that leveraged the next generation of engineers well.

Only minor changes have been made in the mechanical equipment of the newer tunnels. The overall dimensions of each tube have been increased from 29 ft 6 in. to 31 ft 6 in., and the roadway has been increased in width from 20 ft to 23 ft 6 in. Otherwise, the arrangement of roadway, traffic control and ventilating ducts are quite similar to the original.

• **The pioneers**—The engineering team that tackled the design work for that first tunnel: Colonel Clifford M. Holland, chief engineer; Ira B. Shaw, principal assistant engineer; Milton H. Freeman, construction engineer; and Ole Singstad, ventilating engineer, was well equipped with pick of experience in double-tube vehicular tunnels, which had been used for railroad and rapid transit tunnels at New York. Hence similar construction was adopted.

• **Major unknowns**—The major unknowns in these early studies related to ventilation requirements. No one knew how much harmful gas would be given off by motor vehicles in such a tunnel or what concentrations of carbon monoxide the human system could stand without injury or discomfort. A related question was the power required to supply fresh air and remove exhaust gases.

The U. S. Bureau of Mines helped in finding answers to these questions. It made tests at Pittsburgh to determine how much gasoline gas to expect, and the bureau's consultant at Yale, Prof. Yandell Henderson, took over the study of human reaction to carbon monoxide, using students as guinea pigs. Then test runs were made in full scale models of the tubes at the University of Illinois to determine power consumption.

The Yale findings showed that concentrations of four parts of CO in 10,000 would have no ill effect on the human system during a period of one hour. Consequently, the ventilation equipment was designed to provide that dilution. Space was reserved for 50 per cent of the fan requirements, and added to each tube were speed controls and a provision for future blowers in case of subsequent need to reduce the concentrations lower.

An interesting and novel feature of the ventilating system was a provision to spread thin asphalt across the roadway along the gutters all the way from Jersey City to Manhattan. This, which would have been unsightly with the quantities required, was the installation of CO detectors in the exhaust ducts to allow the operator, when the air supply had to be increased because the concentration of CO was above the desired amount.

After the tunnel had been in operation for a few weeks it became apparent that the concentration of four parts of CO in 10,000 was not such as a haze of smoke could be seen above vehicles in the tunnel at that concentration. Consequently, Mr. Singstad, who had become chief engineer following the death of both Mr. Holland and Mr. Freeman, ordered the concentration reduced to 2½ parts per 10,000, at which no smoke is visible.

That concentration has continued to control at the Holland tunnel and has been used in the three tunnels built subsequently.

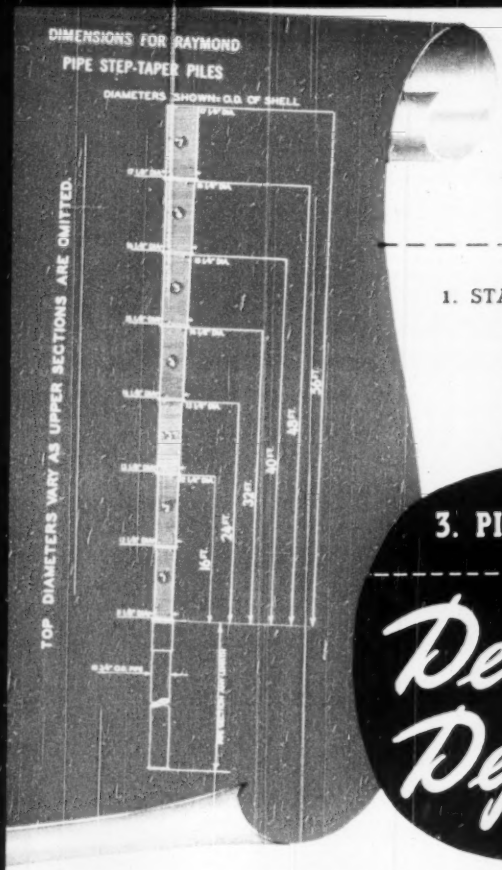
• **Paving and lining**—Granite block paving was specified for the Holland tunnel as being the most rugged type of unit paving available at that time. But before the Lincoln tunnel was built, vertical fiber dedurred brick had come on the market. After a test of that brick in one of the approaches to the Holland tunnel it was specified for the first Lincoln tube and for all subsequent construction.

There has been some evolution in linings. Ceramic tile was specified for the side walls of the Holland tunnel. But there was no satisfactory type of tile for use on the underside of a horizontal surface and concrete was used for the ceiling. Even when painted a light color, this was not satisfactory.

Glass tile bubble plaques, metal strippers were applied to the ceilings in the Lincoln and Queens-Midtown tunnels. Used on the Battery tunnel is a ceramic tile with a lug on the back that can be embedded in the concrete ceiling slab.

• **Lighting developments**—Lighting as noted earlier, shows interesting evolution. Recessed mercury-vapor lamps were specified for the Holland, Lincoln and Queens-Midtown tunnels. Fluorescent lighting was considered for the latter tunnel but was abandoned due to uncertainty as to its efficiency when used in the open tunnel in cold weather.

• **Traffic**—Work on the Holland tunnel started in 1920 and the tubes were opened in November, 1927. Then capacity had been estimated at 46,000 vehicles per day. However, the traffic count on the first full day of operation (a Sunday) was 52,000. A curious coincidence is the fact that almost the same number of vehicles went through the tubes of the Battery tunnel a few weeks ago on the first full day that it was open to traffic.



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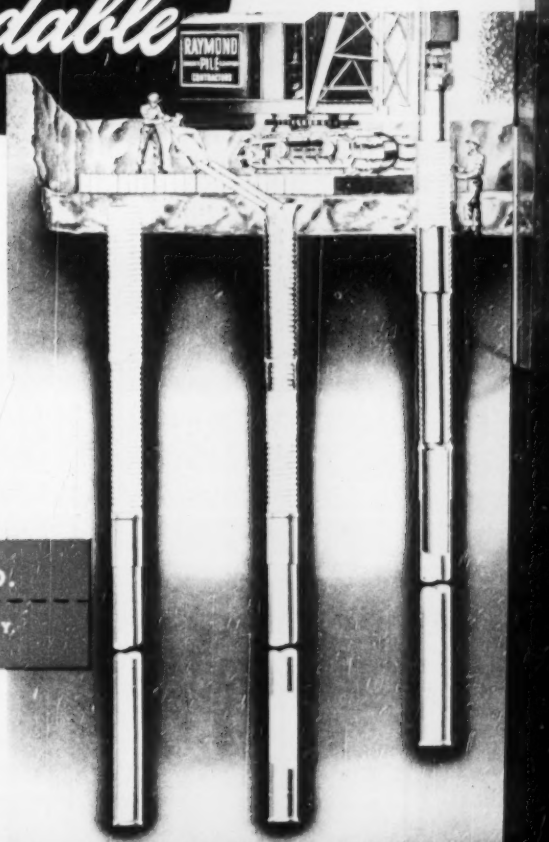

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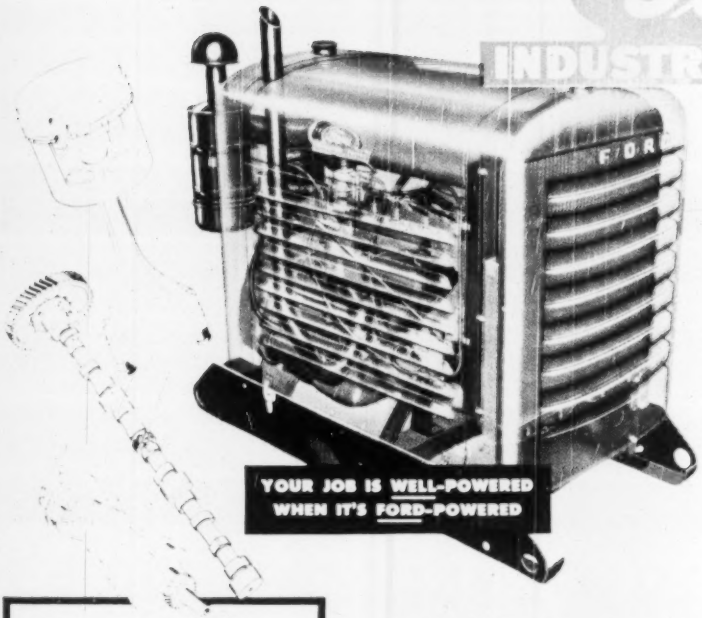

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